NOVEMBER 16, 1959

American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

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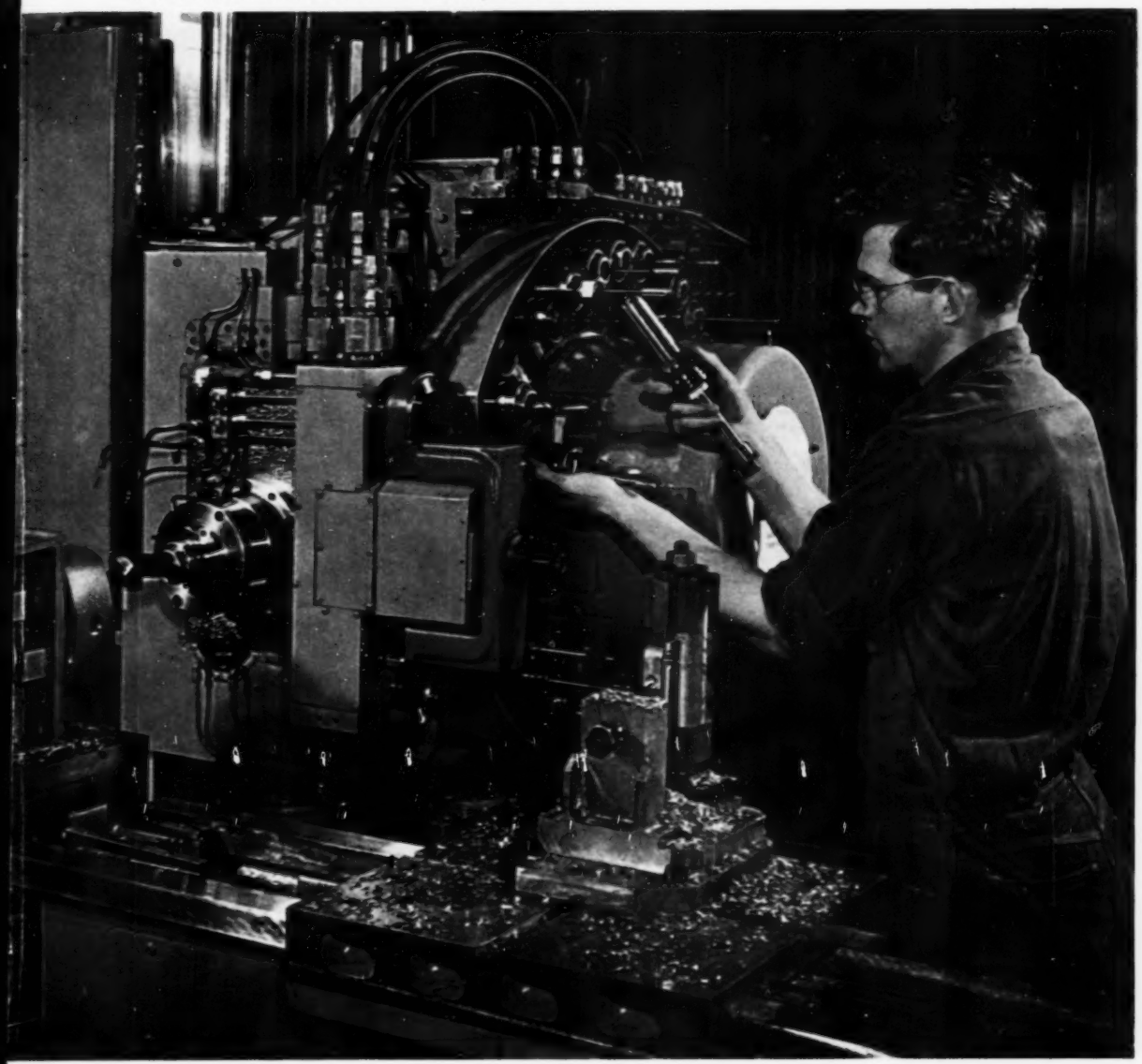
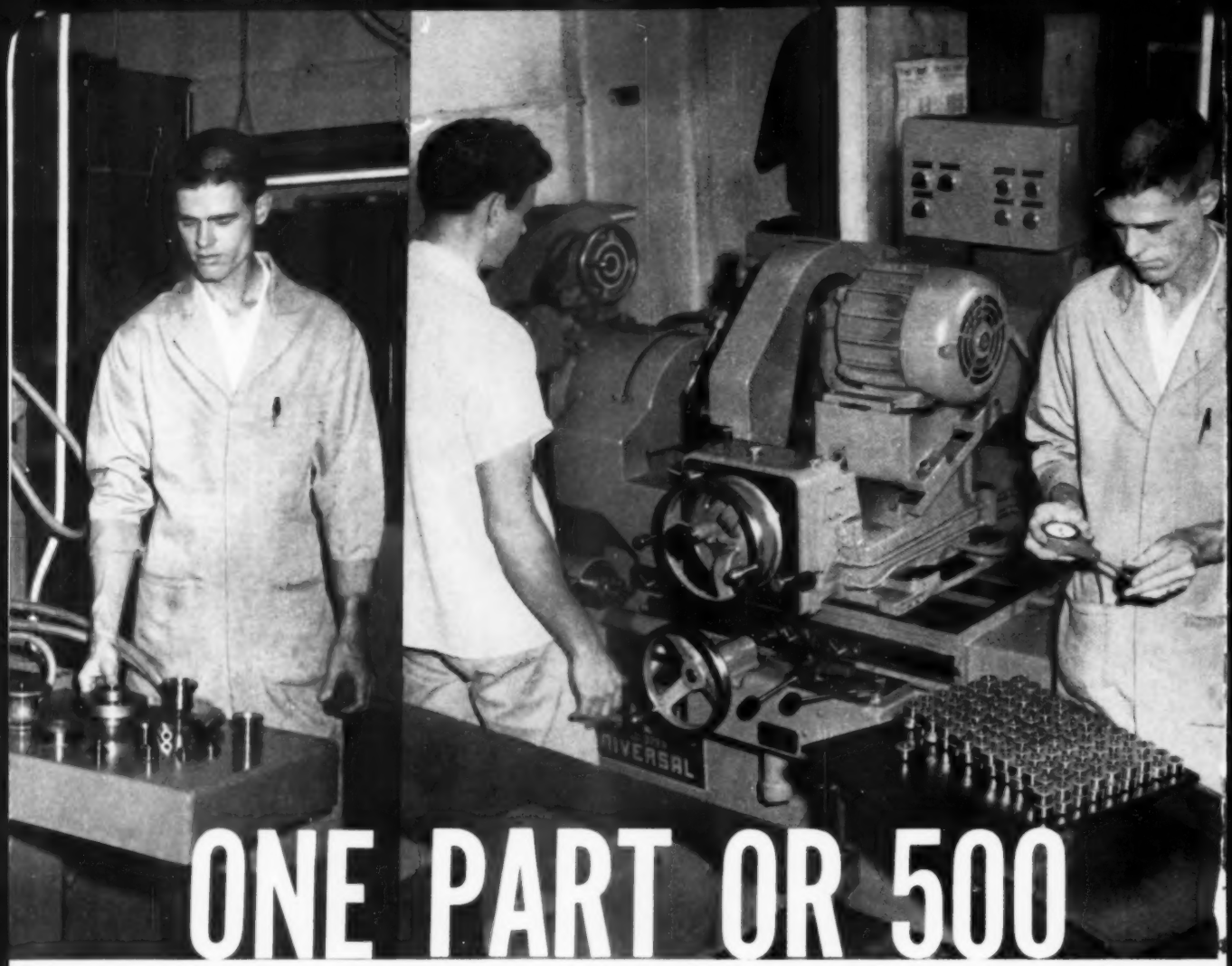


Numerical control changes tooling concepts—see Special Report, page 151

Can USSR compete in Europe's auto market?—page 121

How to make flame hardening pay—page 135



ONE PART OR 500

Selco gets top grinding performance at rock-bottom cost with the

NEW HEALD MODEL 273A UNIVERSAL

The Heald Model 273A Universal Internal Grinder shown above is installed at the Selco Grinding Company — a small but busy job shop in southern California. Here it is used to grind straight or tapered I.D.s and O.D.s, and for rotary surface grinding of flat, convex or concave surfaces of a wide range of work — from individual parts to production runs. And it easily handles every job with far greater speed, accuracy, precision and finer finish than could be obtained on any of their previous equipment.

Until the advent of this Universal Grinder, most small job shops (and many larger ones, too) couldn't afford a machine of this type. But the Heald 273A costs about *half* as much as comparable machines today, and less than similar machines (with fewer features) cost in 1947!

Incorporating the latest advances in the grinding art, it holds tolerances to within .0001" in routine production, and within .000050" in special cases. Features include hydrostatic antifriction ways, full 20" table travel, several wheelhead positions, infinitely variable workhead speed from 150 to 450 rpm and 90 degree workhead swivel for rotary surface grinding.

Ask your Heald engineer for information on the New 273A — the only completely new machine with 1959 performance and a 1947 price tag.

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

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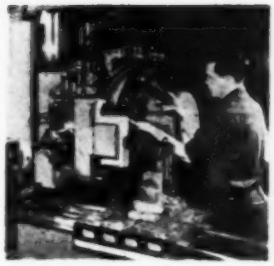
HEALD

It PAYS To Come To Heald

CIRCLE 151 READER SERVICE CARD

COVER:

Automatic tool change is controlled by NC punched tape at this K & T Milwaukee-Matic. Tool change in cycle takes only 9 seconds. See page 151.



American Machinist

THE MAGAZINE OF METALWORKING MANUFACTURING

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METALWORKING REPORT

Significant current developments in tooling and production processes

CUTTING

Numerical Control for Economy

Cutting tools last longer with numerically controlled machines, according to results of a life test of 7 drills that were shifted from a radial drill to an NC machine. Average number of parts/tool increased from 5 to 140—because guide bushings were eliminated, which stopped damage to cutting edges. Another side advantage of NC is reduced lead time, because simpler fixtures can be applied, and once the job has been set up for one part, all machine motions for a new part are ready to go on the tape. One more advantage is reduced inventory of parts in process or completed, because quick setup and simple tooling for NC allows waiting until parts are ordered before production starts. These and other advantages are covered more thoroughly in the special report on numerical control, this issue—p 151.

Safety with Beryllium

One of the best-equipped facilities for machining beryllium, Eclipse-Pioneer Div, Bendix Aviation, Teterboro, N J, has an enclosed machine shop equipped with a 50-hp air conditioner that maintains 72 F. In addition, a 40-hp exhaust system sucks air into nozzles at machining points at the rate of 6000 cfm. Air within the enclosure is changed more than 10 times per hour. Air samples taken at frequent intervals are checked to make sure the toxicity level is kept below 20% of the maximum allowed by AEC regulations.

Most of the machining of beryllium is done on sintered blocks and bars, which produce chips much like those from cast iron, with a high proportion of dust. Breathing even minute amounts of the dust will cause illness and probably death. The Bendix facilities prevent danger by maintaining air purity, and with anterooms next to the machine shop for changing clothes, eating, and showering. The beryllium area is entirely separate from the rest of the plant floor.

FORMING

Cheaper Drawn Panels?

Deep-drawn shapes, such as auto roof panels, door panels, and the like, require huge presses, expensive dies. Now, Frohman Anderson of the Anderson Aircraft Co., North Dighton, Mass, says he has a method that is fast, doesn't require dies, and uses little power.

The technique is not entirely new. The Androform process was used during the war to form aircraft skins by plastically stretching in predetermined and controlled amounts in accordance with the three-dimensional geometric requirements of the product. Anderson Aircraft is still making skins for a variety of aircraft manufacturers on a contract basis.

New features are added controls for forming compound-curved panels and the possibility that an Androform machine may be numerically controlled, can be coupled with a flying shear to make panels from strip at the rate of 15 to 18 pc per min. Some primary and secondary operations in making a panel would be eliminated, space would be conserved, and tooling up would take but a short time.

The Androform process is limited in depth of draw in the direction of strip travel, but a side could be curved upward rather sharply, and indentations applied without a restrike. Example: the Falcon door panel has been made.

One advantage is that a "flat bottomed" panel can be made without excessive application of power. It is said that a roof panel, which might be done on a 1000-ton press, can be handled on an Androform machine with a 25-hp motor or less.

In the forming process, energy is put into the metal without thinning the metal or tearing it. A compound-curved panel in a high tensile material will be rigid and springy. If flattened, the panel will spring back to its original shape when the weight is removed. Thus, materials like aluminum alloys can be formed in their fully heat treated condition, instead of working the material in a softer condition, and then heat treating to develop strength. There is a possibility, therefore, that auto makers might adopt the process for door panels of aluminum to reduce weight.

High-energy Rate Forming

Several developments should break soon in the development of forming by the high-energy rate method. Five major energy sources are being explored:

- **Explosive.** This is the oldest and most familiar of the high-energy rate methods and the first to produce commerical parts. Explosive forming (*AM*—Feb 6 '30, p245 and Jun 15 '59, p127) is the form that first made it clear that results can be obtained at high-energy rates that can't currently be obtained at conventional rates.

- **Pneumatic.** Stored pneumatic energy is released at high-energy rates in the Dynapak (*AM*—Apr 23 '56, p124 and Nov 17 '58, p123). A number of these machines are now in use.

- **High Voltage.** Underwater discharge of a high-voltage spark can create a high-energy shock wave (*AM*—Oct 19 '59, p123). Republic Aviation has done some preliminary work on this technique and at least two other companies have worked in this area.

- **Magnetic.** A demonstration at Geneva last year proved that magnetic energy can create a shock wave

that will form metal, and development work to apply this source has been started.

• **Ultrasonic.** Possibility that forming can be accomplished with induced ultrasonic waves is also being explored.

THE OUTLOOK

Metalworking is facing a situation without parallel in history because of the longest of all steel strikes. Cutbacks and shutdowns are the order of the day in big consumer industries, and now even short-run specialty producers are feeling the pinch. U S metalworking production totals will continue to drop drastically until well into first quarter 1960 (see p115).

HEAT TREATING

Flame Hardening

Recent developments in gas-mixing equipment, operating controls, and burner design point to increasing application of flame hardening; in many cases for jobs long considered restricted to induction hardening.

For a basic discussion on design and selection of burners—the "business end" of any flame-hardening setup—see the article beginning on page 135. It points out the various types of burners available, and shows how they should be used in hardening such items as machine ways, shafts, internal bores and splines.

INSPECTION

Measured in Air

An amazing feat of measuring parts floating in air is being accomplished at Eclipse-Pioneer Div, Bendix Aviation Corp, Teterboro, N J. Surface finish and deflection requirements on a part for the Pershing missile are such that the part cannot be contacted. Hence, an open-air jet is used to pick up the close-tolerance squareness measurement of the ends as the part floats on air.

The part is supported by columns of air emanating from jets in the base of the gage. This gaging technique also serves to give the added value of a true functional check. The squareness tolerance requires 100,000 to 1 amplification and a range where one ten-thousandths of an inch is spread over 10 scale in.

One of Sheffield's newly developed 15-in.-column Precisionaire instruments is used as the amplifying and indicating instrument. Additionally, an electronic sensing stylus, having a gaging pressure of only 5 gr, measures the concentricity of an outside diameter with the bore as the part rotates. This is another illustration of measuring to the sixth decimal place as required for reliability in missile components.

WELDING

Faster Wire Attachment

Low-voltage percussion welding may answer the need for faster and more economical methods of connecting wires to terminals, according to J S Gellatly, K. F. Johnson, and A L Quinlan of the Hawthorne Works of Western Electric Co, Inc.

The process is a capacitor-discharge arc method operating at 50 to 60 volts. The wire is projected toward the terminal at 80 to 90 ips, and the arc duration is about 200 microseconds.

The Hawthrone engineers have developed both hand guns and automatic equipment. One machine will weld two 0.012-in.-dia tinned copper lead wires to the nickel-iron terminals of a switch at the rate of 3600 switches per hr.

Refractory and high-conductivity metals are readily welded. Copper and aluminum wire have been welded to a variety of metals. Wires have ranged from 0.012 to 0.102 in. in dia.

The process can weld components to both sides of printed-circuit boards and it can weld heat-sensitive, solid-state devices—no temperature rise can be detected by touching the connecting wire.

Russians Flame Cut Sheet Metal

A new burner nozzle for warp-free cutting of sheet metal up to 0.080-in. thick has been announced in *Technicke Noviny*, the Czech technical weekly. It is claimed to cut as fast as a normal burner and to yield a much better cutting edge.

The nozzle has the customary central jet passage for the cutting oxygen. Around this are three circles of jet passages: one for acetylene, one for compressed air, and a final one for cold water.

ASSEMBLY

Class 5 Thread Fits

Interference fits—where the stud is larger than the tapped hole—are due for increased attention with the distribution of a new "trial" standard, being published by ASME and ASA. Class 5 threads have only been applied by a few companies so far, but more general familiarity, use, and conclusions from industry should improve working knowledge.

The purposes of interference fits are to provide high breakloose stud torques so the studs will not move when nuts are loaded and removed, to reduce costs of stud assemblies, and to simplify stud driving. Results in scattered applications have shown that plastic flow is necessary when such a fit is driven. Existing standards on threads demand full thread OD's, but with interference fits any galling or welding occurs at the major diameter; therefore special standards may be necessary for interference. It is known that lubrication is required, but where is it best, on the stud or in the hole? More general industrial application of class 5 fits should result in changes in the trial standards, and eventually in established permanent standards.

FINISHING

Simplifies Galvanized Welding

A simple solution of 32 oz potassium dichromate to a gallon of water has been found by Westinghouse lighting div, Cleveland, to provide an effective mask to simplify welding galvanized metal. The solution is applied at 120 to 140 F to the weld areas prior to galvanizing and remains in contact for two min. The surface is then dried and galvanized. After welding, the ungalvanized areas are shot blasted and zinc-sprayed.

Single-Solvent Finishing System

Based on Dupont "Triclene," an integrated cleaning, phosphating, and painting machine has been developed by G S Blakeslee & Co, Chicago. Work passes through a vapor degreasing section to remove all grease and soil, and directly into a phosphating chamber where it is sprayed with a trichlorethylene-based phosphatizing solution. As it leaves the chamber it dries almost instantly and passes into the painting section where trichlorethylene is used as the paint thinner. The unit provides a completely nonflammable setup, reduces floor space, and saves on capital investment, paint, thinner, and drying time and equipment.

METALWORKING REPORT...

MATERIALS & COMPONENTS

Rare Steel Improvers

Yttrium and some other rare metals have extremely beneficial effects on "workability, grain refinement, and resistance to recrystallization at elevated temperatures" of various steel alloys. This rare metal, according to General Electric scientists reporting at the American Society for Metals—AEC symposium, may hold the key to heat-resistant metals needed in atomic flight and the space age.

An outstanding example, they point out, is AISI 446 stainless steel, containing 25% chromium, with the balance primarily iron, which is oxidation-resistant to 2000F. Alloying a small amount of yttrium to this composition provides an alloy with oxidation resistance as good at 2500 F as is the alloy minus yttrium at 2000 F. Iron-chromium-yttrium alloys are readily cold rolled and easily welded.

Combining this yttrium - containing alloy with 3% aluminum provides an oxide coating at 2600 F which is enamel-like, hard, nonchipping, and thermally shock resistant.

Ductile Chromium Tubing

First successful extrusion of pure chromium metal tubing was accomplished recently by Dr. James Wong of Nuclear Metals, Inc. Pure chromium powder was cold-compacted into a mild-steel container, heated, placed in a 1000-ton press and extruded over a mandrel. The resulting tubing was nearly perfect in form. Even though it originally was a powder, the extruded metal had a density close to the theoretical density of pure, solid chromium. In this form it could become a remarkable structural material, corrosion and oxidation resistant, as well as strong to 2000 F. Ductile chromium sheet could prove very interesting for high speed aircraft and missile skins.

Aluminum Armorplate

Initial orders for aluminum ballistic armorplate have been placed by Food Machinery and Chemical Corp's Ordnance Div. Metal will be used in the first production models of the M-113, the Army's new lightweight personnel carrier. The plate is high-strength, weldable aluminum alloy 5083, developed by Kaiser Aluminum and Chemical Corp. Weighing nine tons, the vehicle replaces the Army's present 20-ton steel M-59 carrier. Level of protection is said to be the same.

MATERIALS HANDLING

Extruded Aluminum Container

How do you ship heavy but precision-made aircraft and missile parts? Conventional containers — wood or welded sheet metal—can be too heavy, hard to handle, and poor for outside storage.

A new container, used by the Air Force to ship rocket engines, is pressurized, shock-mounted, and stackable. Made with integrally stiffened aluminum extruded skin panels, welded into cover and bottom assemblies, the container has a modular design that permits size variations in depth, width, and height.

Developed by Harvey Aluminum (Torrance, Calif), the container is lightweight (welded-steel containers are 80% heavier, wooden ones weigh 135% more), can be re-used, and is said to withstand the most rugged handling.

Company is also designing aluminum containers that are 100 feet long or more, to package missile airframes. Here the container skins will be heavy press cylindrical extrusions; bulkhead supports will be thin-web press forgings.

MANUFACTURING CONTROL

Tab-Machine Inventory Control

A ten-character code is the key element in a new material-control system at a Westinghouse plant. Adaptable to data-processing equipment, the code catalogs each type of material the plant stocks. Because it identifies each piece of material in all phases of design, manufacturing, and purchasing, it improves plant communications.

The new coding system has another advantage: The material catalog, assembled from printouts of electronic tab machines, is cheaper to maintain and reproduce than the one it superseded. For the complete picture, read the story beginning on p 140.

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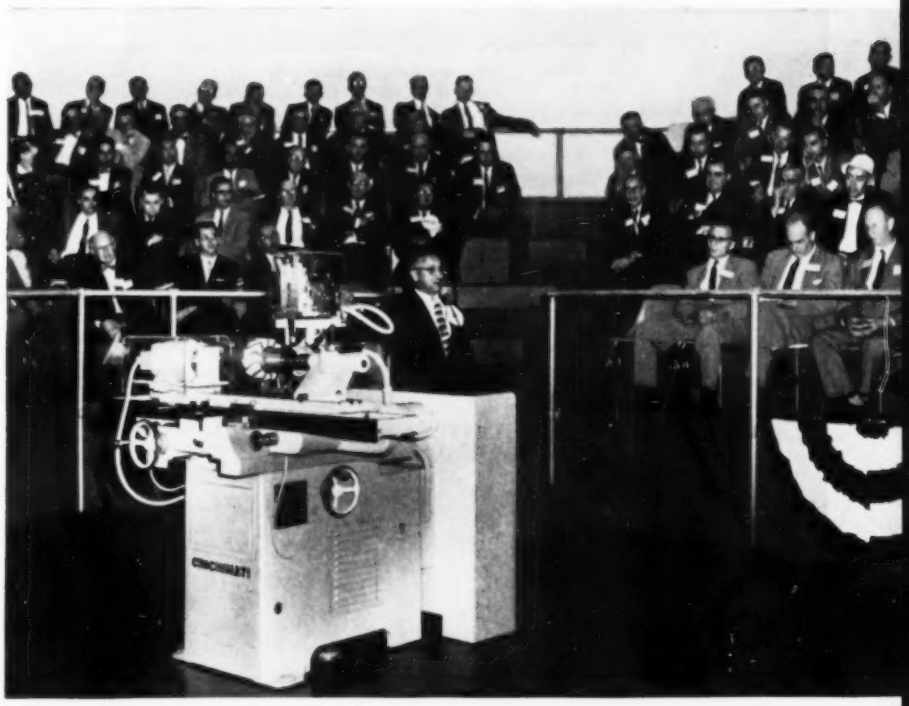
. . . and this candidate, gentlemen,

cuts the cost

of repetitive cutter sharpening operations



thousands witness unveiling of new Cincinnati Automatic Cutter Grinder... at Cincinnati Milling's recent 75th Anniversary program. This new machine, introduced by the Milling Machine Division, initiates a brand-new concept in cost prevention . . . *the automatic precision sharpening of cutters.* The machine has three general areas of application:

1) Production sharpening for cutter manufacturers.
2) For shops requiring frequent sharpening of a large volume of similar cutters.
3) Servant machine to production lines. Operators of these lines now can sharpen their own cutters and keep ahead of requirements.

The new CINCINNATI Automatic Cutter Grinder is a fitting companion to five others in the universally accepted Cincinnati line: No. 1, No. 2 Monoset, Contour and Projecto-Form. More information about the new Automatic member of the Cincinnati family will be found on the two pages following. **Milling Machine Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.**

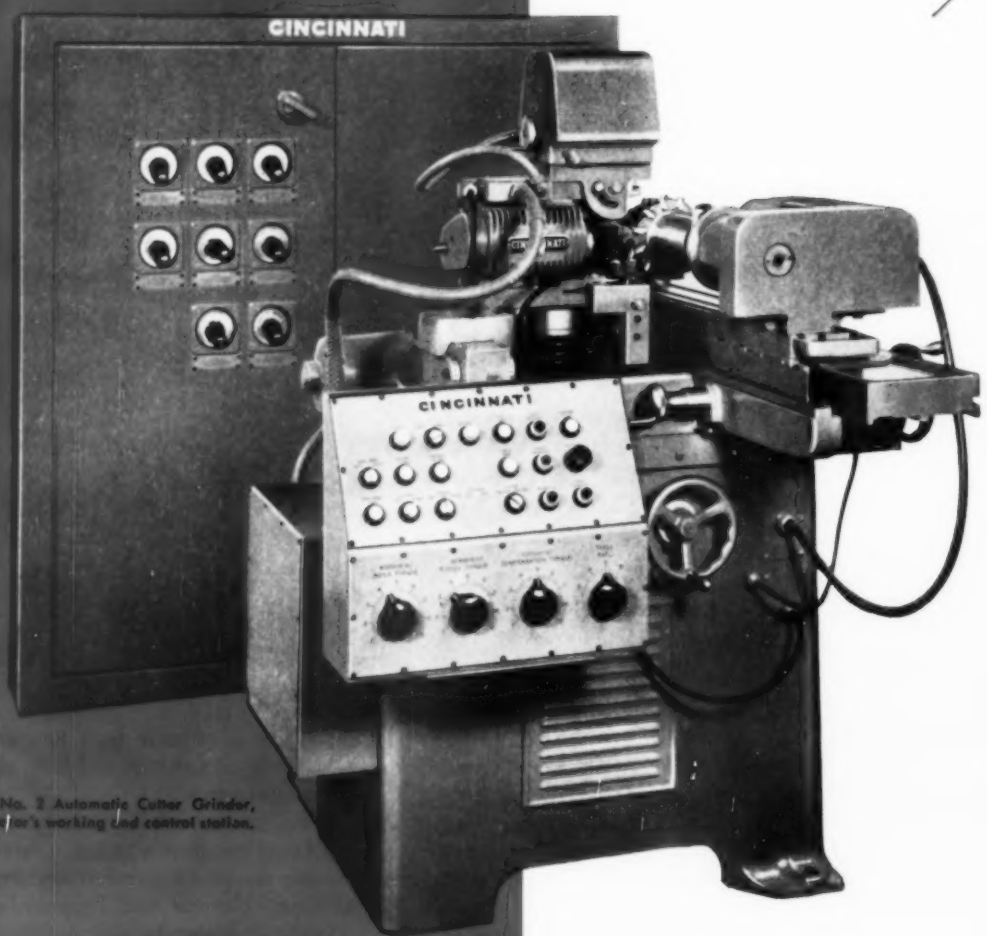
KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES
• CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI®
MILLING MACHINE DIVISION

AUTOMATIC CUTTER SHARPENING IS HERE!

New Cost Prevention Machine

CINCINNATI



New CINCINNATI No. 2 Automatic Cutter Grinder, showing the operator's working and control station.

BUILDERS OF FINE MACHINE TOOLS: KNEE TYPE AND BED TYPE MILLING MACHINES • DIE SINKING MACHINES •

THE CINCINNATI MILLING MACHINE CO., CINCINNATI 9, OHIO

CIRCLE 155 READER SERVICE CARD

CINCINNATI

introduced by

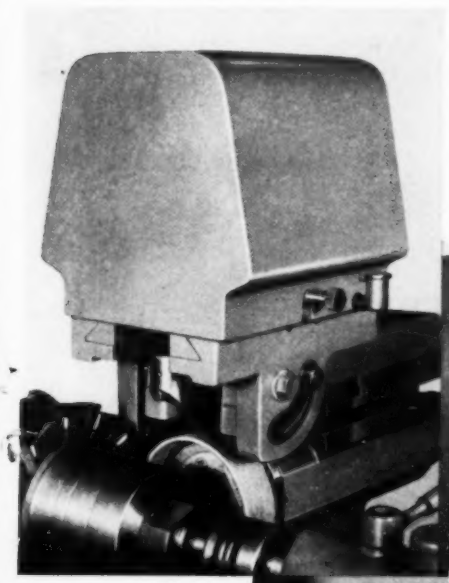
MILLING MACHINE DIVISION

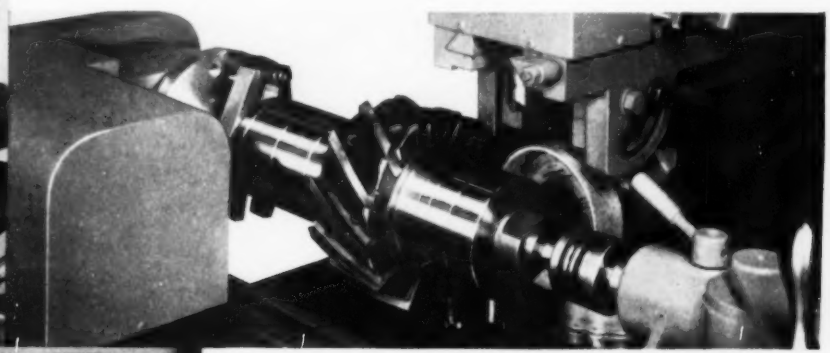
Correctly sharpened cutters are good cost prevention for metalworking shops. In general, however, the grinding operation is a manually controlled "art." But now the new CINCINNATI Automatic Cutter Grinder transforms the variables of an "art" into positive, precise, automatic operation. Every cutter conforms to the exact accuracy of the one preceeding it. Here's the way in which this new machine produces such amazing results.

The wheel is trued automatically. At preset intervals, the diamond advances .001", and for each advance of the truing attachment the saddle pickfeeds .001" to restore basic settings. Anti-friction ways for the saddle assure accurate pickfeeding, which can be adjusted in increments of .00025". A high degree of concentricity is obtained by virtue of the 180° cutter rotation after the first revolution and one or two revolutions of sparkout.

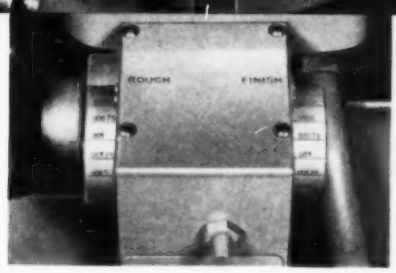
Many additional feature-advantages give the new CINCINNATI Automatic Cutter Grinder unique qualifications as a production machine for cutter manufacturers and as a *cost prevention* machine for high volume users of plain and stagger tooth milling cutters. Complete information in catalog M-2111. Write for your copy.

Automatic wheel truing is synchronized with automatic pickfeed of saddle to compensate for amount trued off wheel.





Typical cutter being ground on CINCINNATI No. 2 Automatic Cutter Grinder. Complete cycle, including indexing, is automatic.



Increments of automatic saddle pickfeed are dial selected, in increments of .00025", from .00025" to .005".

CUTTER AND TOOL GRINDERS • ELECTRICAL DISCHARGE MACHINES

CINCINNATI
MILLING MACHINE DIVISION

CIRCLE 156 READER SERVICE CARD

FELLOWS GEAR PRODUCTION
Builds Extra Quality

View of production floor at Stanley Electric Tools, showing some of the Fellows Gear Production Equipment used.

Gears produced with Fellows Machines add high quality to these Stanley Electric Tools.

THE PRECISION LINE

Fellows

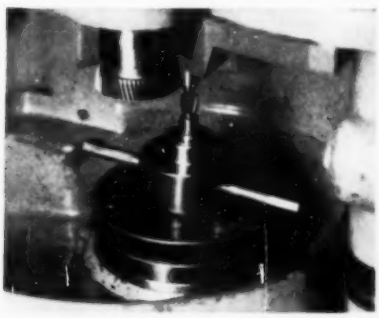
EQUIPMENT at Lower Cost for STANLEY

Stanley is a name you know . . . a name that stands for high quality in electric tools.

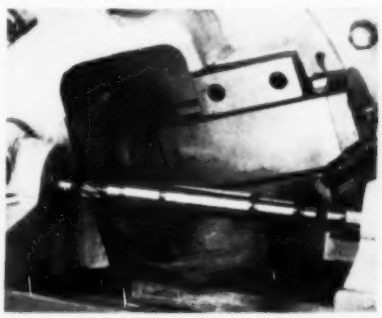
To insure this quality, while providing the high production rates that mean lower costs, Stanley Electric Tools, Division of The Stanley Works at New Britain, Conn., uses Fellows Gear Production Equipment for shaping, shaving and inspecting the armature pinions for its electric tools.

Fellows has long been the leader in Gear Production Equipment, with machines for every gear production job: Fellows Gear Shapers, Pfauter Gear Hobbers, Fellows-Reishauer Gear Grinding Machines, Fellows Gear Shaving Machines and Fellows Inspection Instruments.

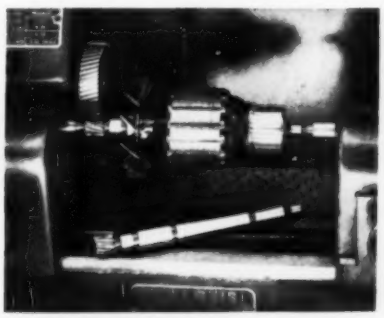
If you make gears of any size, from 1/16″ P.D. to 120″ P.D., Fellows' 60 years of experience can help you improve quality and cut costs. For complete information on Fellows Gear Production Equipment, call your nearest Fellows office.



SHAPING. The versatile No. 7125 Fellows Gear Shaper gives Stanley high production speeds (up to 450 strokes per minute). It also provides fast, simple changeover from one job to another.



SHAVING. The No. 4 Fellows Fine Pitch Shaving Machine puts finishing touches on each pinion and adds the finish which results in long life and quiet operation.

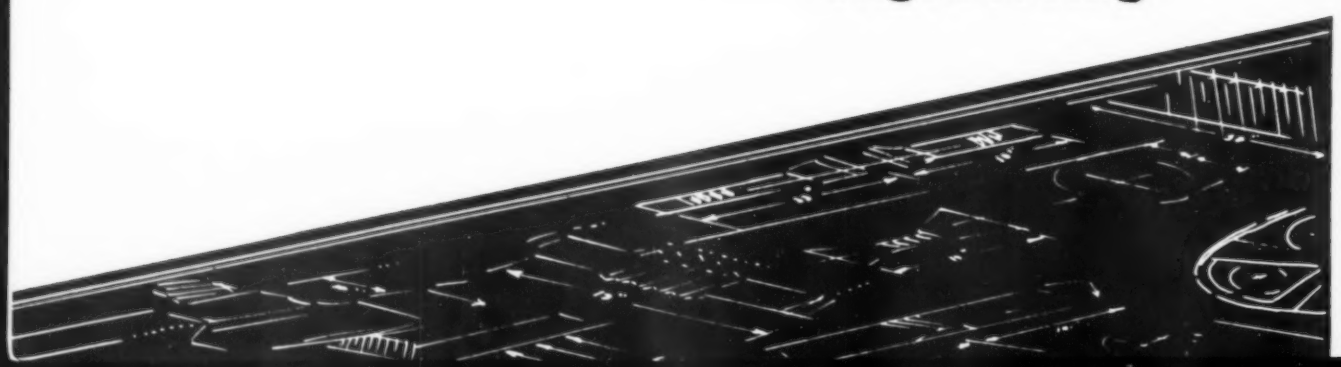


INSPECTING. The No. 4 Fellows Fine Pitch Red Liner makes and records a composite check of gear accuracy, insuring high quality standards.

Gear Production Equipment

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
319 Fisher Building, Detroit 2
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Seven out of ten successful threading operations require engineering



Recent Landis sales figures show that 7 out of 10 successful Threading Operations require some Engineering to assure the utmost in Threading efficiency. "Threading Equipment by Landis" includes Engineering Service geared to offer help with any Threading Operation. This Engineering Service is the best available. Backed by the resources of the World's Largest Manufacturer of Threading Equipment, our Engineering Department is able to handle every type of Technological requirement.

For example, a LANDIS 32AX LANDMATIC Heat Treated Die Head was recently engineered for application to a No. 1AC Warner and Swasey automatic chucking machine to produce two different thread diameters simultaneously in one pass on a single workpiece. This two diameter threading greatly reduced threading and material handling time.

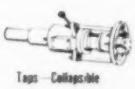
Plants everywhere benefit from the knowledge our Engineering Department applies to every threading operation. Advice on thread design, the proper threading method to use, the proper threading equipment to use, and the development of special tooling, fixtures, or equipment for unusual operations are among the services offered. Engineering Service can also mean much to you in the solution of your daily Threading Problems—whether in Cutting, Rolling, Tapping or Grinding.

LANDIS *Machine* COMPANY

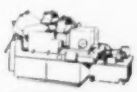
WAYNESBORO • PENNSYLVANIA

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

Threading Machines



Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines

Thread Rolling Machines

Die Heads—Rotary & Stationary

Thread Rolling Tools

CIRCLE 160 READER SERVICE CARD

LANDIS
micro

feed

automatically cancels all variables affecting work size

MICROFEED is the most notable advance in precision grinding accuracy in years. New Landis grinders with MICROFEED will produce parts to extremely close tolerances regardless of machine temperature variations, wheel wear, wheel pressure changes and work variations.

Precision to your tolerances on a production basis is assured, automatically.

LANDIS

precision grinders

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

MORSE

helps to make

MACK

Mack TRUCKS

mighty...

two famous names noted for

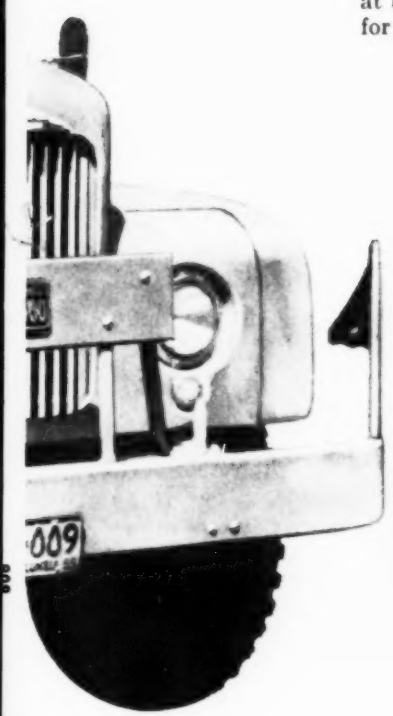
GUTS

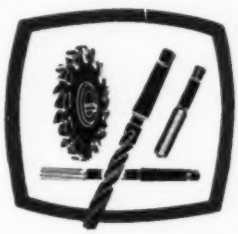
Mighty Mack Trucks . . . and the Morse cutting tools used to make them . . . are equally famous for *guts*. Mack on the road. Morse on the production line. Proof once again that to build the best you must build *with* the best.

Sound economics? Sure. Longer lasting more efficient tools *invariably* produce long-run economy.

Why not prove it to yourself. Your Morse-Franchised Distributor will gladly demonstrate to you the *practical* economics of buying the best in cutting tools . . . Morse, of course. *Call him in today.*

P.S. If you want to get the most out of the best twist drills made today, take a look at the Morse Production Drill Point Grinder. It *outpoints all other* machines. Write for new illustrated bulletin.





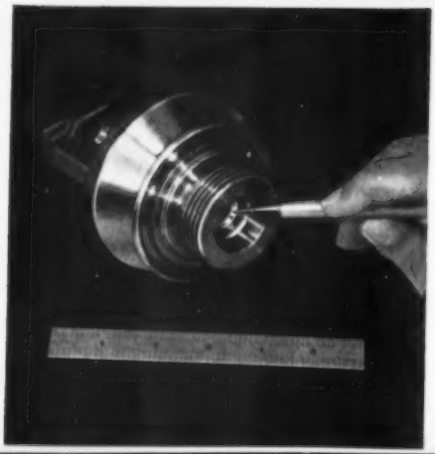
Morse CUTTING TOOLS

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS

WAREHOUSES IN NEW YORK, CHICAGO, DETROIT, DALLAS, SAN FRANCISCO

A Division of VAN NORMAN INDUSTRIES, INC. VNI

MORSE *means* "THE MOST" *in Cutting Tools*



MACHINING TIME (first operation) on the bonnets—involving many complicated forming cuts—was reduced from 40 to 28 minutes per piece when taken from Efco's older machines and put on the new No. 5 Warner & Swasey Ram-Type Turret Lathe. Secondary operation on the No. 5 includes two 8-pitch Acme threads and finishing the internal seat which is 60% cobalt.

Efco's savings of 12 minutes per piece on the first operation was primarily the result of longer cutter life on the complicated form tools. Contributing to the virtual elimination of downtime for cutter grinding and replacement on smaller lot sizes were the new No. 5's "ideal-speed-increment" headstock, rigidity and vibration-free performance—all important factors in machining today's tougher alloys.

CIRCLE 165 READER SERVICE CARD

At Efco Manufacturing, Inc.

PROVIDENCE, R. I.

Rigidity, accuracy and vibration-free performance of Warner & Swasey No. 5 Turret Lathes

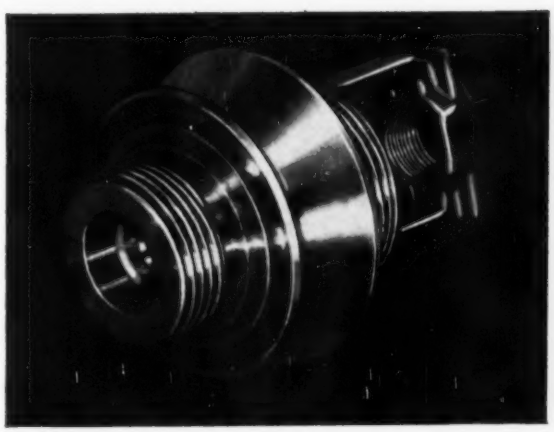
- *Eliminated scrap loss*
- *Held .001 total tolerances*
- *Produced 32 micro-inch surface finishes*
- *Reduced production time 30%*

on these costly Monel valve bonnets

Over the past 13 years Efco has shifted their production emphasis from simple jobbing work to complex work requiring close tolerances and fine finishes in the more-difficult-to-machine materials—such as Haynes alloys, Monel and 300 and 400 series stainless steels. They'll contract for one or thousands of precision parts—delivered on time—all guaranteed to meet specifications.

A case in point is this bonnet for a 2-inch capped globe valve produced by Efco for the Navy's new nuclear submarines. Its function is to control demineralized water used in the sub's atomic reactor. On a 30-piece lot, Efco is furnished *only* 30 forgings, each worth $80. There is no provision made for scrap loss during machining—and with modern Warner & Swaseys, Efco requires none.

Why not take a page from the Efco Story and have your Warner & Swasey Field Engineer give you all the cost-cutting facts on these versatile No. 5 Turret Lathes. You'll be glad you did.

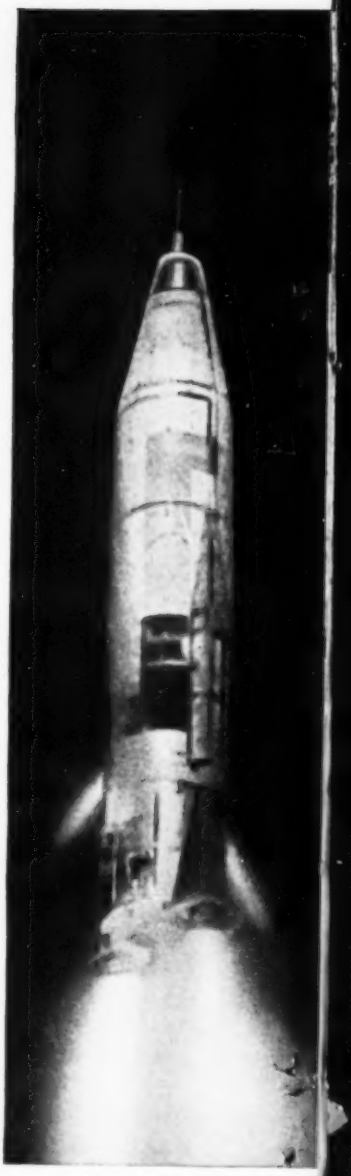


WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

NO REPAIR SHOPS IN OUTER SPACE

SO REPUBLIC STAINLESS STEEL BARS HELP INSURE RELIABILITY



There is no opportunity for repairs once a "bird" is launched or is airborne.

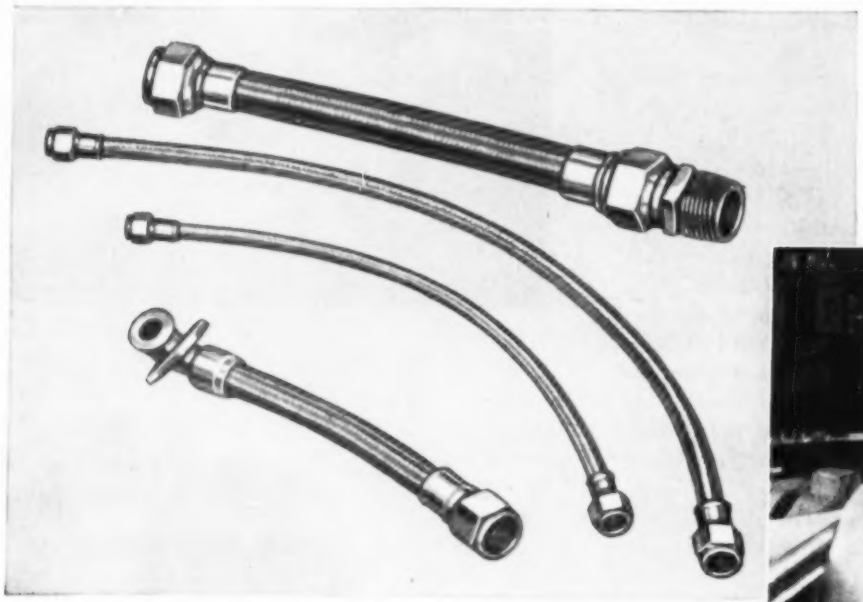
This fact is of prime consideration in a new high pressure hose assembly designed, developed, and manufactured by Resistoflex Corporation, Roseland, New Jersey. The hose is used for handling highly corrosive fluids in jet aircraft, missiles, and rockets.

Utilizing a new type plastic sheathed in stainless steel wire braid, the hose features stainless steel fittings. Sockets, nipples, flanges, elbows, and swivel nuts are machined from ⅛-inch and 2-inch diameter stainless steel bars, of which Republic is a supplier. Fittings are permanently attached to the hose by swaging.

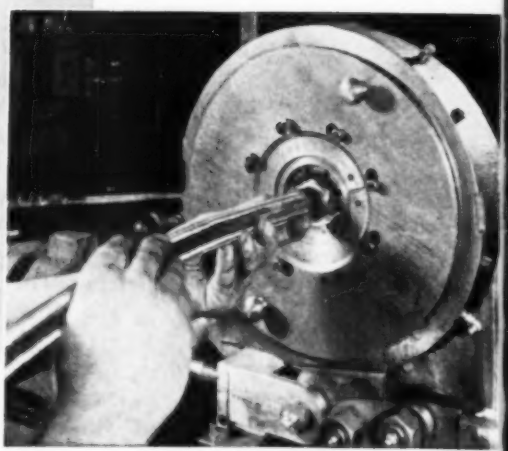
Republic Cold Finished Stainless Bar quality meets Resistoflex's high purchasing, inspection, and testing standards. Additionally, the bars meet the company's requirements for machinability, superior strength, and maximum corrosion-resistance.

If you machine stainless steel parts, you will like working with Republic ENDURO® Cold Finished Stainless Steel Bars. Here is a material with extremely high physical strength and excellent chemical properties. To these features have been added the advantages provided by the cold finishing process—close tolerance, accuracy of section, uniform soundness, fine surface finish.

Republic also supplies ENDURO in hot rolled bars, special bar sections, and wire. Machining specialists are available without obligation to assist you in obtaining the best possible results when machining Republic Stainless Steel Bars. The coupon is your invitation to use this service.



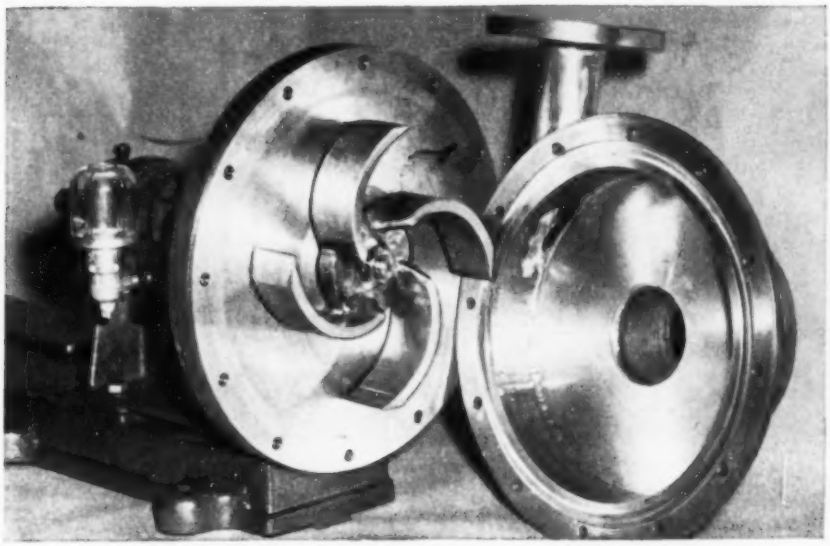
Resistoflex high pressure hose is sheathed in stainless steel wire braid. Various type fittings are machined from Republic Stainless Steel Bars.



Machined stainless steel fitting is permanently attached to hose in this crimping operation. Fittings are formed on automatic screw machines.

COLD DRAWN SPECIAL BAR SECTIONS lower costs, improve quality, increase production. Formed to the predominating cross-section of the part. Republic Special Bar Sections eliminate or greatly reduce required machining. Results are faster output and lower cost. Also, since cold drawing improves the mechanical properties of any given analysis, completed parts are stronger and longer wearing. Other advantages may include simplified design and improved appearance. Send coupon for complete facts.

HOT ROLLED BAR PRODUCTS from industry's most complete range of sizes and materials — carbon, alloy, stainless, and titanium — in ⅜" rd. to 10" rd. and equivalent footweight sections. Republic can meet your exacting requirements for high quality. Newly completed facilities are producing high quality alloy and carbon steel bar products in heavier coil weights, and more uniform sections.



TITANIUM fabricated economically and without difficulty into centrifugal pump parts. The pump parts shown above were fabricated by shaping, welding in an inert gas atmosphere, and machining. The entire fabricating operation was performed without difficulty and with little change in procedure as compared to other materials of construction. Does this application spark an idea for your product that needs to be strong, lightweight, and corrosion-resistant? Republic Machining Specialists will help you apply titanium's advantages now.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
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1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Send more information on:

☐ Cold Finished Stainless Steel Bars ☐ Hot Rolled Bars
☐ Cold Drawn Special Bar Sections ☐ Titanium

Have a machining specialist call
☐ Stainless Steel ☐ Titanium

Name_____ Title_____

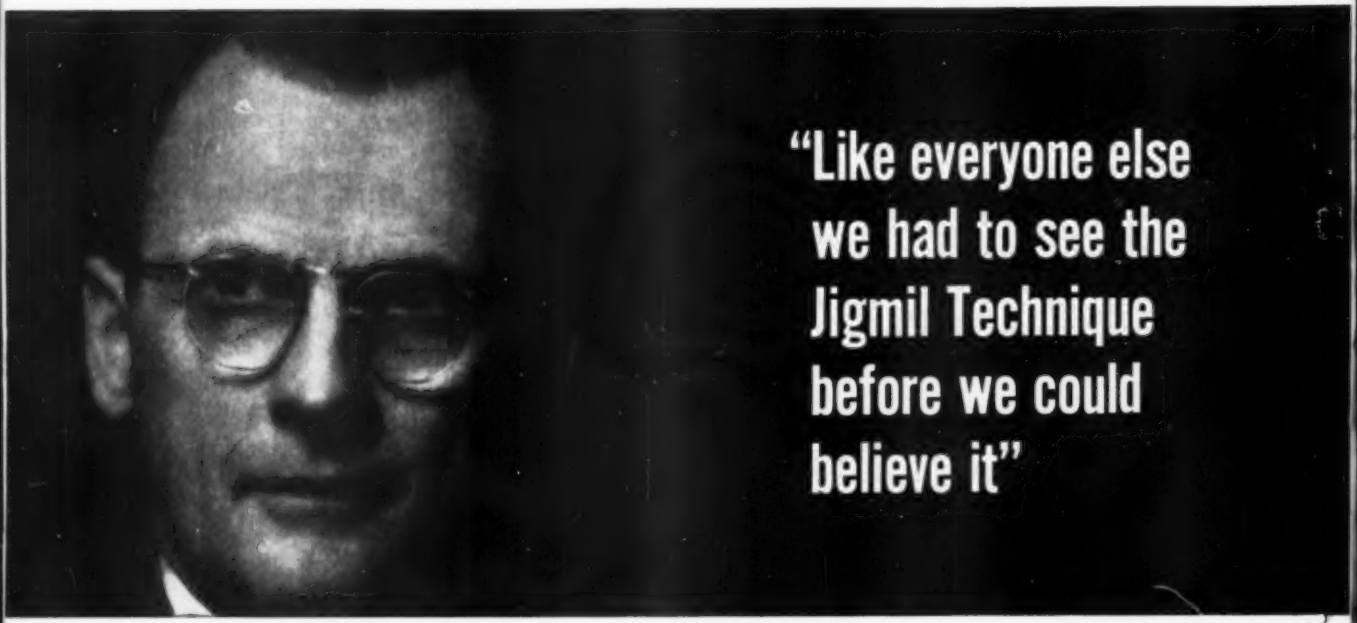
Company_____

Address_____

City_____ Zone____ State_____

RICHARD F. MOORE, President
Moore Special Tool Co., Inc.

a man who came to Fair Street



"Our visit to Fair Street resulted in the purchase of three JIGMILS. The machines are part of a complete retooling program to help us meet rising costs and hold the line on our prices. We use the JIGMILS to machine larger jig borer and jig grinder parts to the fine accuracies required in our own machine tool products. We do not believe that we could design and build a special machine for our own needs that would beat the JIGMIL. For us, the JIGMIL is the last word."

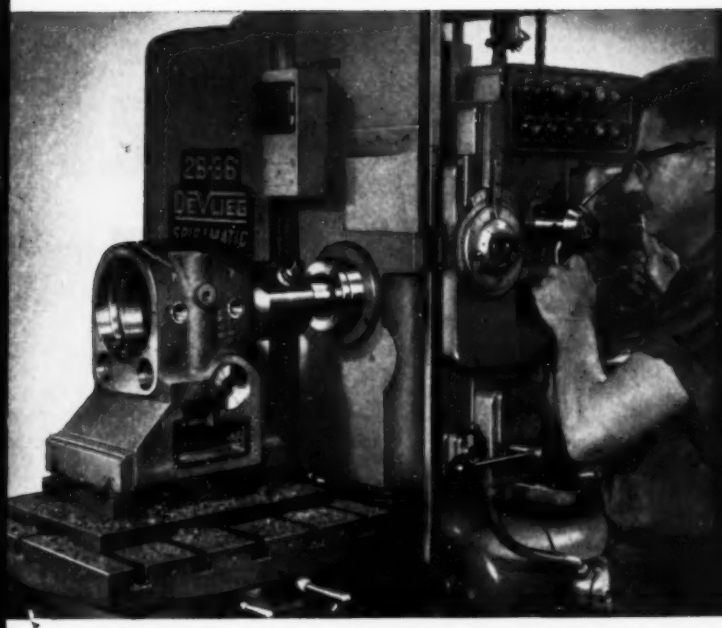
RICHARD F. MOORE

DE VLIEG MACHINE COMPANY, FAIR STREET • **ROYAL OAK, MICHIGAN**

CIRCLE 169 READER SERVICE CARD

SOME OF OUR JIGMIL USERS

American Steel Foundries
Avey Drilling Machine Co.
Axelson Manufacturing Co.
Baldwin-Lima-Hamilton Corp.
Barber-Colman Company
Blanchard Machine Co.
E. W. Bliss Co.
Boyar-Schultz Corp.
Brown & Sharpe Mfg. Co.
Bryant Chucking Grinder Co.
Buhr Machine Tool Co.
Cincinnati Milling Machine Co.
Cincinnati Shaper Co.
Cleveland Automatic Machine Co.
Cone Automatic Machine Co., Inc.
Crankshaft Machine Co.
Cross Company
Davis & Thompson Co.
Detroit Broach Company
Ex-Cell-O Corporation
Foote-Burt Company
Gisholt Machine Co.
George Gorton Machine Co.
Gould & Eberhardt, Inc.
Greenlee Bros. & Co.
Heald Machine Company



ADVANTAGES OF THE JIGMIL TECHNIQUE reported by Moore Special Tool Co., Inc.

- Fast, fool-proof positioning
- Quick tool changes
- Fast indexing of part to four sides
- Retraction of table for measuring
- Depth of hole stops
- Quick change of wide spindle speed range
- Large range of boring bars from DeVlieg stock
- Easy accessibility to controls

ACCURACY IS AN ECONOMY!

JIGMIL—THE MACHINE TOOL BUILDERS' MACHINE TOOL

Moore uses its three JIGMILS with DeVlieg Microbore boring bars to mill, bore, drill and tap large components for its own line of ultra precision machine tools. A jig grinder spindle housing is shown being machined on their 2B-36 JIGMIL equipped with a DeVlieg 20" x 20" index table. Parts are rough and finish machined to precise limits of accuracy on four sides in one setting by simply indexing the index table.

Ingersoll Milling Machine Co.
Jones & Lamson Machine Co.
Kearney & Trecker Corp.
Landis Tool Co.
R. K. LeBlond Machine Tool Co.
Lees-Bradner Company
Lodge & Shipley Company
Mechanical Specialties Co.
Moore Special Tool Co., Inc.
National Automatic Tool Co., Inc.
National Machinery Co.
Onsrud Machine Works
Rockford Machine Tool Co.
Snyder Tool and Engineering Co.
Sundstrand Machine Tool Co.
Warner & Swasey Company

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Our newest catalog will help you decide. May we send it?

DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

CIRCLE 170 READER SERVICE CARD

PROFILED
for precision work in more than 3,000 shapes, sizes and cuts.

Heller

American-Swiss®

Swiss Pattern Files

INSIST ON THE BEST! Skilled craftsmen do. That's why you'll always find Heller Swiss Pattern Files wherever delicate or intricate parts require the perfect finishing touch. Their fine-cutting teeth are designed to stay sharp longer. So, they speed work and cut costs.

AMERICA'S BROADEST LINE! There's a size and shape for every corner, curve and cavity in the book. This preferred line of precision instruments also includes needle files and rifflers in handy sets.

SELL BY SERVING! Offer your customers and prospects free surveys of their file requirements . . . and tailor your inventory to fit. Your Heller salesman will be glad to help.

CALL YOUR LOCAL DISTRIBUTOR
Heller for Heller
SERVICE • STOCKS • SAVINGS

HELLER TOOL CO.

HELLER TOOL CO. SINCE 1836

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branch Offices and Warehouses: Newark, N. J. • Detroit • Chicago • Shreveport • Los Angeles • Portland, Oregon

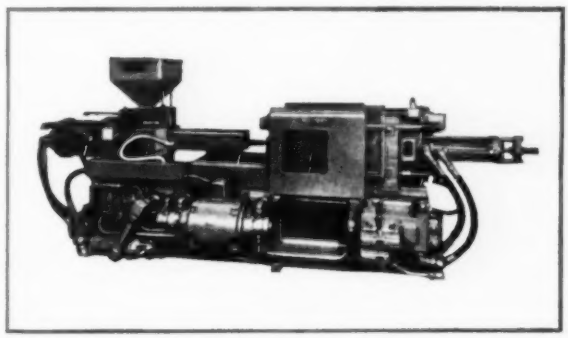
NOW! Let General Electric ECONO-MATCH Motors to Meet Your Specific Drive Requirements

You have over *three billion* different designs and types of integral hp a-c motors to choose from. And, it is increasingly difficult and costly to make this choice. It will pay you to find out how General Electric engineers can help you do this motor selection job.

THIS NEW MOTOR SELECTION SERVICE, ECONO-MATCHING, is the optimum matching of motor to machine and application for over-all economy, improved machine performance and greater reliability.

HOW ECONO-MATCHING WORKS—G-E engineers work closely with your designers studying machine characteristics: speed, torque, duty cycle, life expectancy, environmental conditions, etc. Then, through use of computers and advanced design techniques, General Electric can supply exactly the motor required for your job.

FOR EXAMPLE, the Reed-Prentice injection molding machine, shown at right, had been using a standard 40-hp motor. By ECONO-MATCHING, G-E engineers determined that a smaller, lighter, more compact 30-hp motor with improved electrical characteristics could do the job required. Although this special 30-hp motor cost slightly more than a standard 30-hp, it provided greater efficiency and cost considerably less than the 40-hp motor it replaced. It also cut space and weight requirements. G.E. has also ECONO-MATCHED motors for crane, compressor, and other applications.



GENERAL ELECTRIC

MAIL THE ATTACHED COUPON TODAY . . .

or call your nearby General Electric Apparatus Sales Office for complete information on how G-E can ECONO-MATCH a motor to meet your specific requirements.

Section K891-21A
GENERAL ELECTRIC CO.
Schenectady, N. Y.

Please furnish more information on how you can ECONO-MATCH a motor for my application which is _____

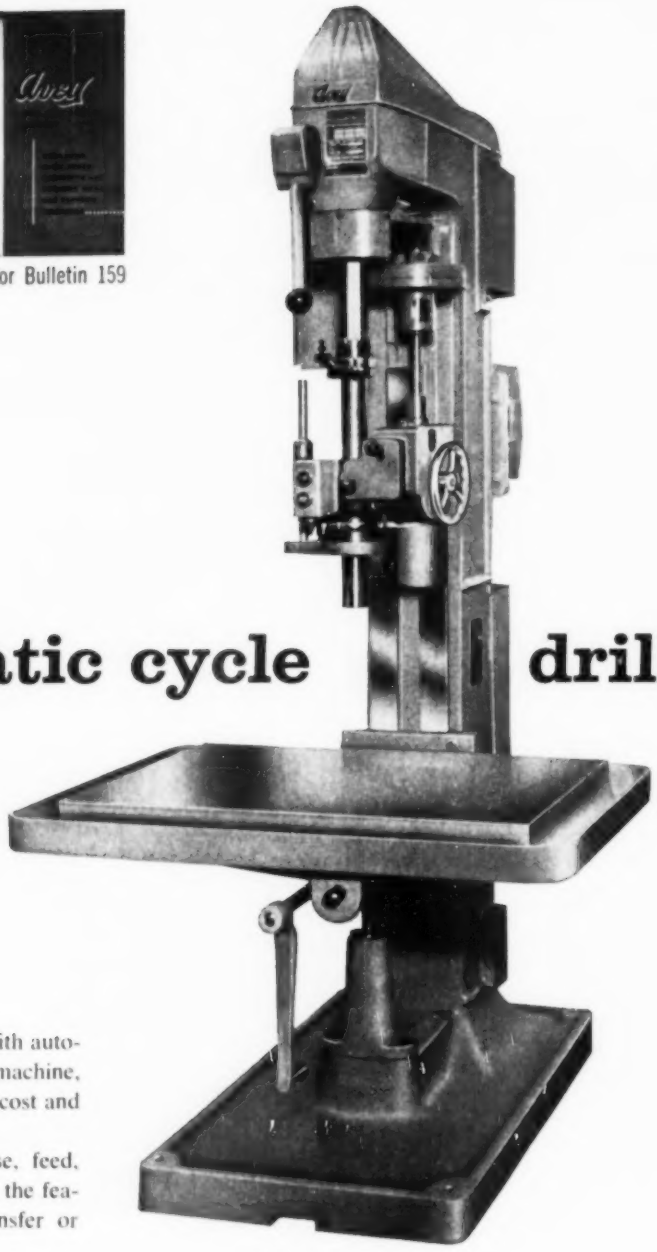
NAME _____ TITLE _____

COMPANY _____

CITY, STATE _____

CIRCLE 172 READER SERVICE CARD

Write for Bulletin 159



automatic cycle drilling

■ You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit.

Adjustable rapid power traverse, feed, and rapid return of the spindle are the features which permit automatic transfer or rotary index fixturing.

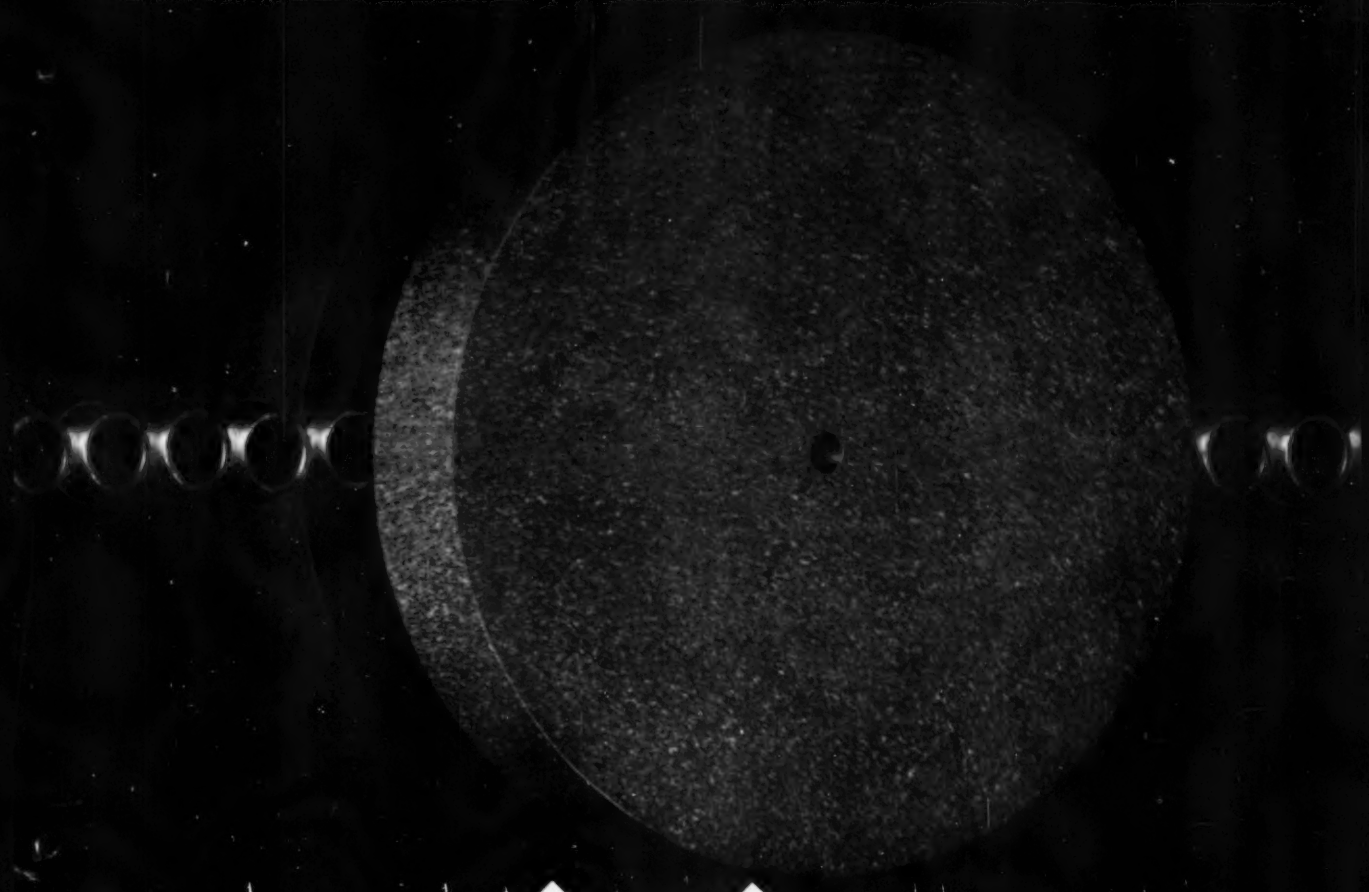
At the same time, you get adjustable feeds, speeds, table travel, head travel, and Avey's advanced spindle construction.

The machine is available with No. 2, 3, and 4 Morse Taper; 1 to 3 HP motors; single or multiple spindles. Your request for additional information will be promptly answered. Avey Division, The Motch & Merryweather Machinery Co., P. O. Box 1264, Cincinnati 1, Ohio.

Avey

Gardner solves problem of grinding unequal areas with two disc specifications

discs with different bonds and structure permit high production grinding to desired tolerances

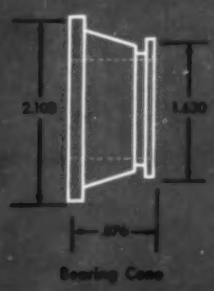


Gardner BGR disc specification

- wider grain spacing
- deep grain penetration
- effective chip clearance

Gardner BKGR disc specification

- fast stock removal
- cool cutting
- effective chip clearance



Call the Gardner Abrasives Specialist for practical solutions to your disc grinding problems.

GARDNER

abrasive discs

BELOIT, WISCONSIN

minor diameter and 28 involute serrations

in this automotive rear axle differential side gear

LAPOINTE-BROACHED

in LESS THAN 4 SECONDS!

It may sound incredible, but the fact is that a production rate of 960 broached parts per hour is maintained on this fast LAPOINTE Vertical Pull Down Broaching Machine!

Here's how it's done: The machine operates on a 15-second cycle, broaching 4 steel-forged parts at a time; machine has a fully automatic belt conveyor unit which can be loaded by the operator at the preceding machine, or automatically from plant conveyor system. (The machine automatically stops if blanks cease coming on conveyor belt.)

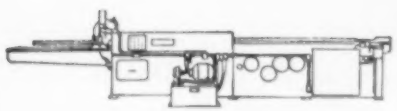
You should convert to Lapointe-Broaching, if you are producing gears or other parts similar to this one . . . or if you are making *electric motor laminated stator cores.* Why not invite a Lapointe Field Engineer to show you how to cut production costs with Lapointe Broaching?

THE LAPOINTE MACHINE TOOL COMPANY

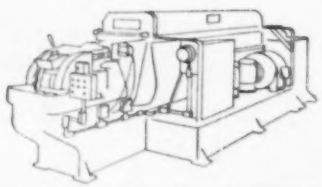
HUDSON, MASSACHUSETTS · U.S.A. *In England: Watford, Hertfordshire*

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

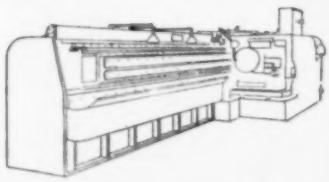
Here's a line of ELECTRO-MOTIVE DRIVE BROACHING MACHINES . . . . . available only at LAPOINTE



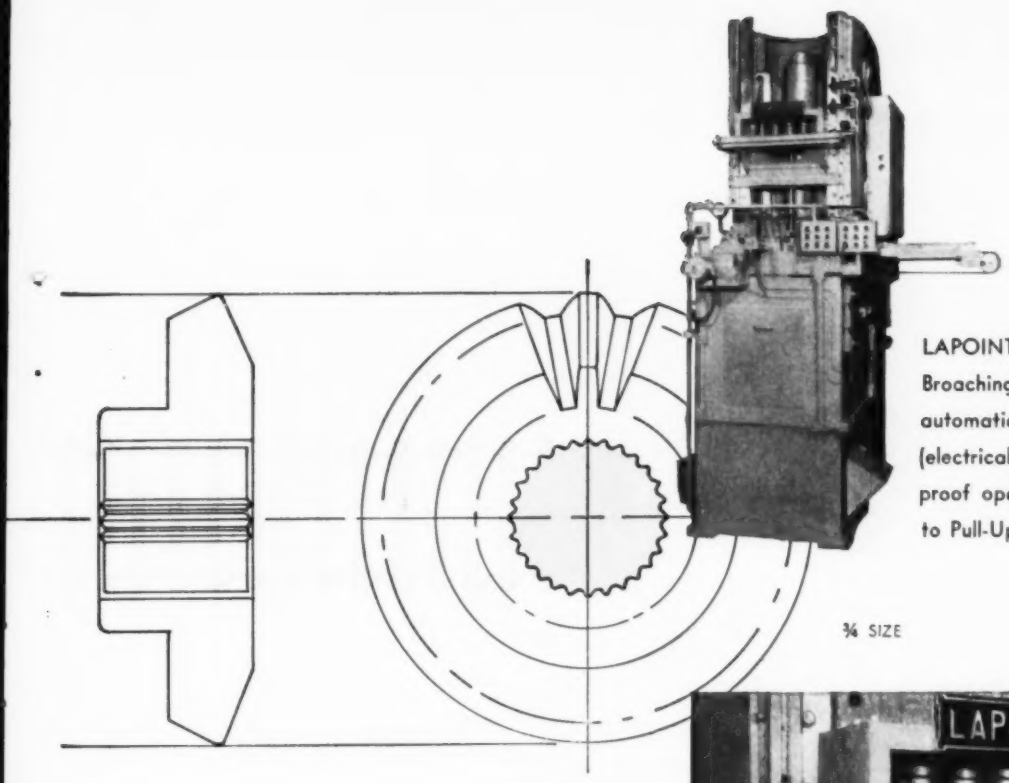
60" STROKE HORIZONTAL, ELECTRIC



CH CONTINUOUS BROACHING, ELECTRIC



SRHE SINGLE RAM HORIZONTAL, ELECTRIC

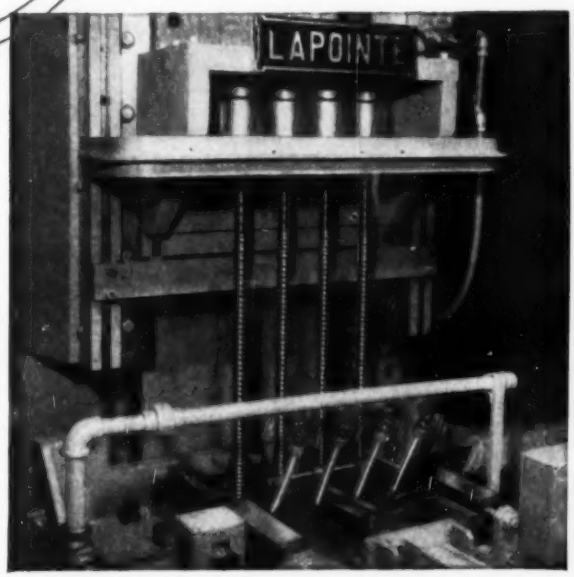


LAPOINTE V3 Vertical Pull Down Broaching Machine, equipped with automatic part conveyor unit (electrically interlocked for fool-proof operation). Also adaptable to Pull-Up Broaching Machine.

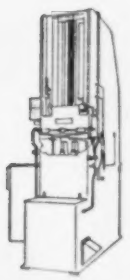
¾ SIZE

The automatic part-conveyor substantially reduces operating cost!

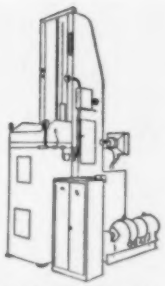
Investigate the cost of re-equipping your present manual-loading Lapointe Pull-Up or Pull-Down Broaching Machine to do broaching of this nature. Automatic loading equipment saves the cost of one operator and justifies its purchase within two years.



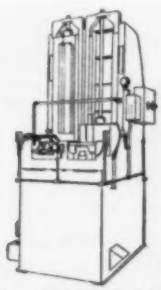
Close-up of fixturing and tooling.



VUE-7 VERTICAL PULL-UP ELECTRIC



SRVE SINGLE RAM VERTICAL, ELECTRIC



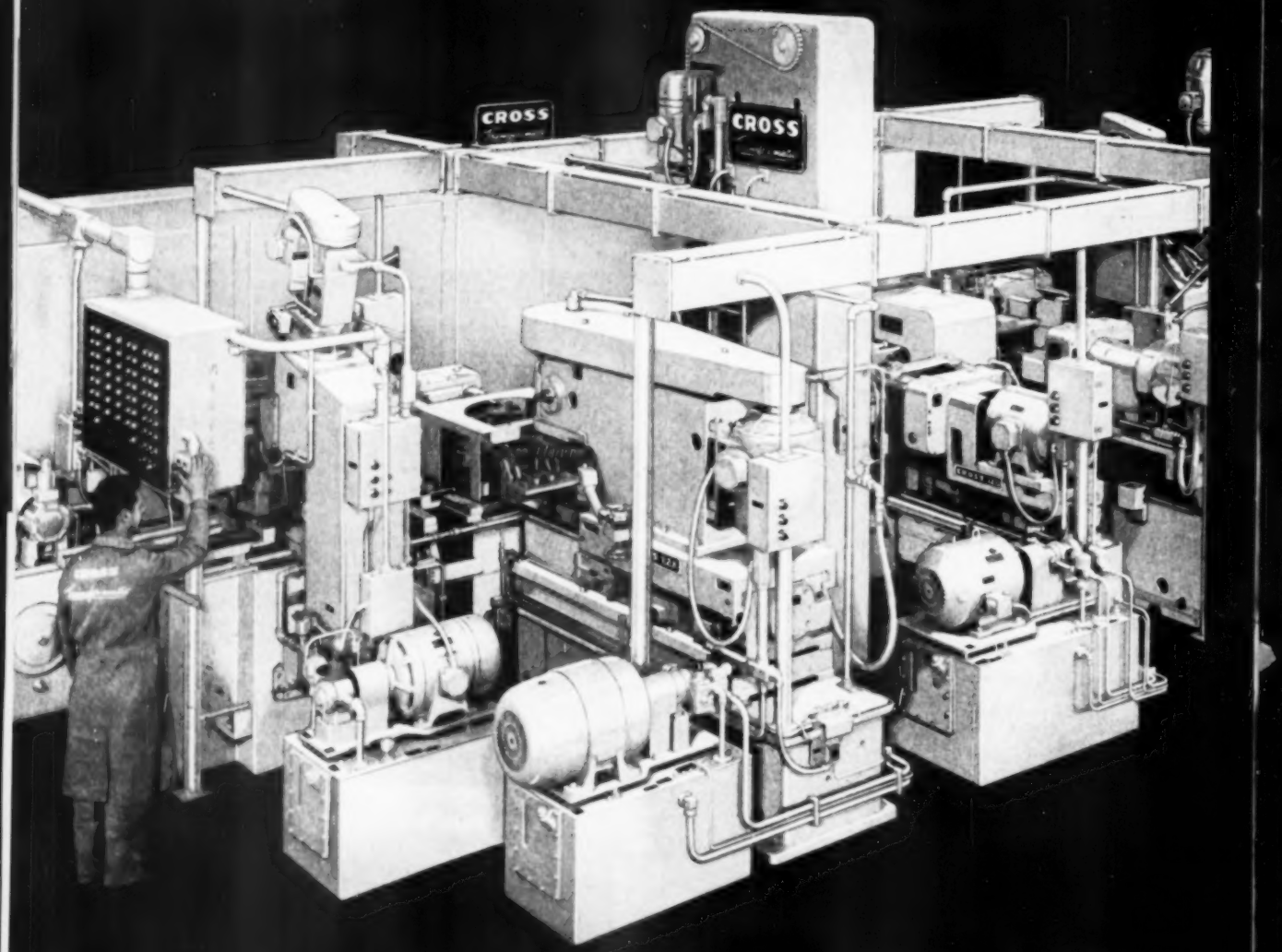
DRVE DOUBLE RAM VERTICAL, ELECTRIC

LAPOINTE

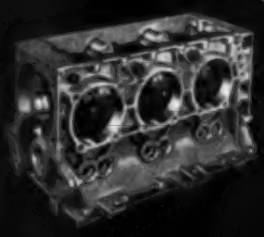
known to be the best in

BROACHING

New Cross Transfer-matic Developments Reduce Machine Down Time Problems

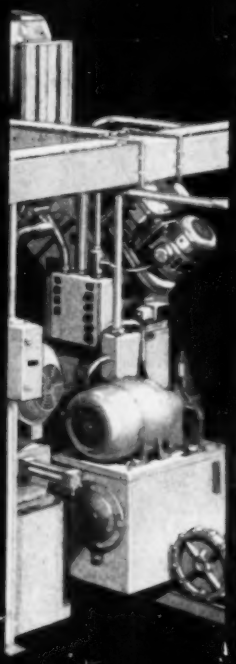


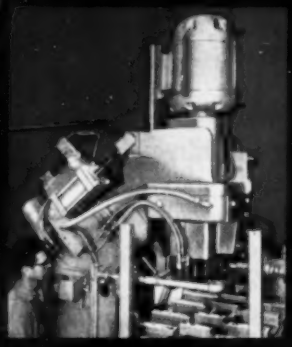
PART: Crankcase assembly.
OUTPUT: 128 pieces @ 100%.
OPERATIONS: Milling, drilling, reaming and tapping.



The cutter changing mechanism overcomes problems usually encountered where heavy, large diameter milling cutters are mounted on vertical spindles.

The head is a standardized Cross adjustable spindle "building block" unit for heavy duty production milling.





As shown above, the "swivel head" is in operating position. For changing tools, the head is "swiveled" by a manually controlled hydraulic cylinder as shown below.

More Automation Progress by Cross

Innovations For Greater Accessibility, Faster, Easier Tool Changing and Electrical Trouble Shooting

Several new design developments in this Cross Transfer-matic for machining 6-cylinder, aluminum crankcase assemblies contribute significantly to reduced predictable and unpredictable machine down time for tool change and electrical trouble shooting.

LESS PREDICTABLE DOWN TIME: A cutter changing mechanism on the milling head at Station 4 handles the cutter for the tool set-up man, speeds up cutter replacement, prevents blade chipping and promotes safety.

In the final station of the machine, a new "swivel mounting" arrangement is employed on a 19 spindle tap head. For changing tools, the head is swiveled out of the work area thus providing maximum accessibility for easier, fast tool changes.

LESS UNPREDICTABLE DOWN TIME: Electrical trouble shooting on this machine is greatly simplified by another new Cross development—integral machine unit push button-terminal stations. All terminal wiring formerly located in the wing base has been combined in the push button panel. By removal of all wiring from inside the wing bases, unpredictable electrical failure from exposure to coolants and moisture in the base is prevented and accessibility minimizes downtime for trouble shooting.

To prevent scratching and scuffing of the locating surfaces of this aluminum part, a lift and carry mechanism is employed.

Cross "building block" construction permits economical conversion as part design changes occur.

In your next tooling job, make Cross Transfer-matics your first choice for production milling, drilling and boring operations.

Established 1898

THE **CROSS** CO.

First in Automation

PARK GROVE STATION • DETROIT 5, MICHIGAN

CIRCLE 178 READER SERVICE CARD

ARMSTRONG

T-SLOT CLAMP

SET-UP AND HOLD-DOWN TOOLS

STEP BLOCK

ARMSTRONG Set-up and Hold-down Tools reduce setting-up time—keep men and machines producing. Designed for use on planers, drill presses, milling machines, etc., they hold work securely and rigidly, and thereby reduce spoilage and prevent costly accidents.

Your local Armstrong Distributor carries ARMSTRONG Set-up and Hold-down Tools in stock in sizes for every operation. Stop haphazard setting-up methods. Provide each of your machines with a full complement of ARMSTRONG Set-up and Hold-down Tools.

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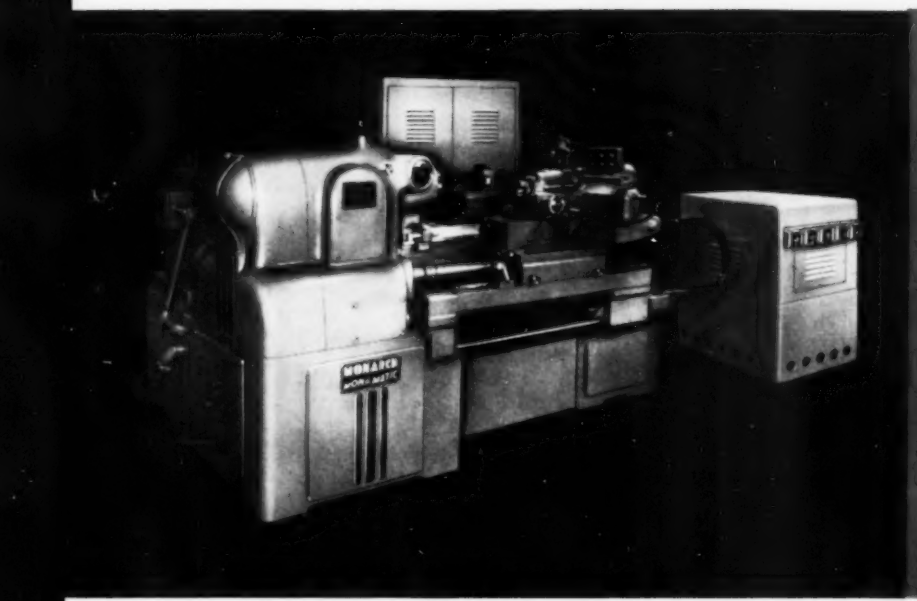
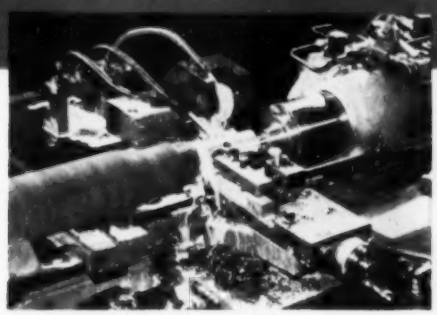
Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes



MONARCH'S HIGH PRODUCTION LATHES OF TOMORROW...



Model 20-H Mona-Matic is available in 18", 30" and 42" center distance. Swing over bed is 15"; over front slide and rear slide ways, 8". Bed ways are flame hardened and ground.

4.. The New Model 20-H Mona-Matic—A Low First Cost Production Lathe

Take a good look at what we've done to the Mona-Matic concept of production turning. This new machine

(1) *Carries a low price tag, because of simplified design*

(2) *Has fast hydraulic feed and traverse movements, making it exceedingly productive*

(3) *Is a dependable day after day performer, requiring only routine maintenance for years of trouble-free service*

The Model 20-H is a fully automatic double carriage turning machine, with a 60° "Air-Gage Tracer" controlled front tool slide. A variety of automatic cycling arrangements provides high productiveness and versatility. Eight spindle speeds are available by pick-off gears in each of three standard ranges. The tailstock has an air actuated spindle and inbuilt, heavy duty, anti-friction center.

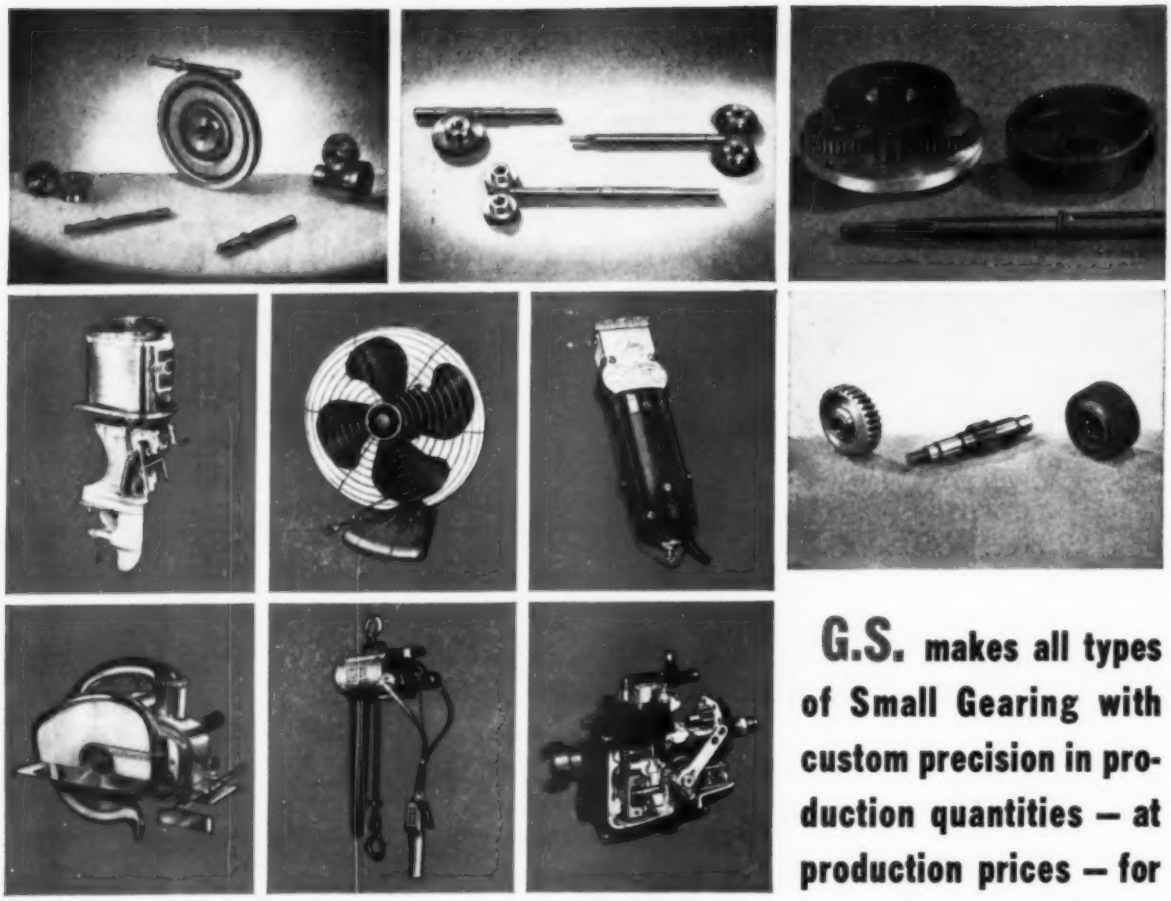
Front carriage feed rate is infinitely variable from 1" to 40" per minute; traverse is 200" per minute. Rear slide feed rate is ½" to 40" per minute while traverse is at 90" per minute.

Four different feeds are available to the carriage. Either a one or a two cut cycle can be furnished. Two cut cycle machines are provided with a selector switch for one or two cut operation.

Imagine better performance at lower cost these days! Why not let us set up a demonstration on your parts? *The Monarch Machine Tool Company*, Sidney, Ohio.

Monarch
TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER



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If you need Small or Intermediate Gears of any type, made to meet high-precision specs, G.S. can do more for you, too — whether it's a matter of developing better methods of power transmission for new projects, or improving performance and costs on old ones. Our engineers are at your service — call or write us today.

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43 Years of Specializing in Small Gearing!

PRODUCTION POINTERS

from **GISHOLT**

MASTERLINE GISHOLT SINCE 1887

FIVE FASTERMATICS SAVE 46% ON PANHARD AND LEVASSOR "PL17" CRANKSHAFT ARMS

Fixtures, smart tooling and machine features simplify work on tough steel forgings

Fixture work giving you headaches—in lengthy machining times, high tool costs and excessive reject rates? You may find some new answers by checking this setup at Panhard and Levassor Automobiles, Paris, France, plant.

Nine semi-automatic lathes were used to produce a wide variety of steel crankshaft arm forgings in lots of 500 to 1000 pieces. Time cycles were lengthy. Parts were hard to hold and machine, and consistent quality was a problem. As a part of its quality improvement and modernization program, the firm investigated various other methods.

Gisholt MASTERLINE 1F Fastermatic Automatic Chucking Turret Lathes, with smart fixturing and standard tooling, were found to best meet this company's needs for consistent quality, versatility, quick setup and lower production costs.

For the first operation on a typical part, framed at left, below, the rough forging is placed in a special chucking fixture. This fixture is adjustable for all sizes of parts. Jacks locate longitudinally. The counterweight rests in a stationary V-block, locating for height. A V-shaped centralizing jaw grips from the opposite side. Two additional jaws, at the left and right, also grip the work.

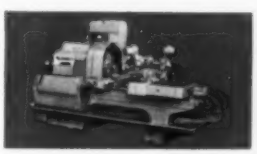
The heavy black surfaces on the drawing are machined from the hex turret. Facing of the hub, the counterweight and thrust bearing surfaces, shown in red, is handled from the front and rear cross slides. Floor-to-floor time is a fast 5.2 minutes.

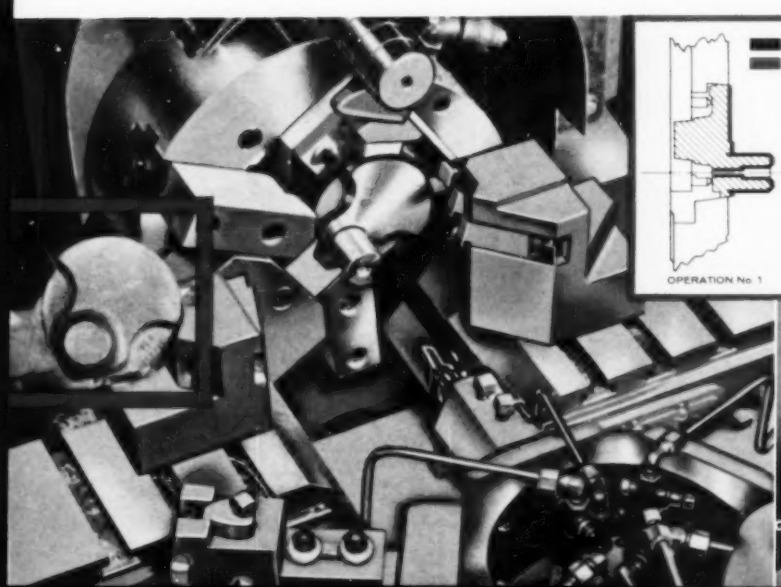
The second operation on a second 1F Fastermatic completes the opposite or crank end of the part. Work is chucked and located on previously machined surfaces. Front and rear cross slide tools face the crank end, the outer edge of the flange, and form one groove as shown in red on the Operation 2 drawing. All other machining handled from the hex turret is shown in black.

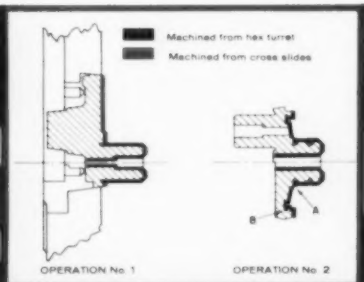
The grooving operation on Surfaces A and B is worth remembering. It is handled by two tools, in a cam-operated, turret-mounted, facing slide tool. Tool clearance problems are solved by an angle cam, mounted on the slide tool. Forward movement of the hex turret saddle engages the angle cam with a roller bearing on the rear cross slide top (encircled at lower right). Continued forward movement of the turret saddle forces the slide tool to move transversely, engaging one tool on each side of center. Reverse of the hex turret saddle at the end of the cut provides automatic tool relief. Floor-to-floor time for this operation, 4.9 minutes.

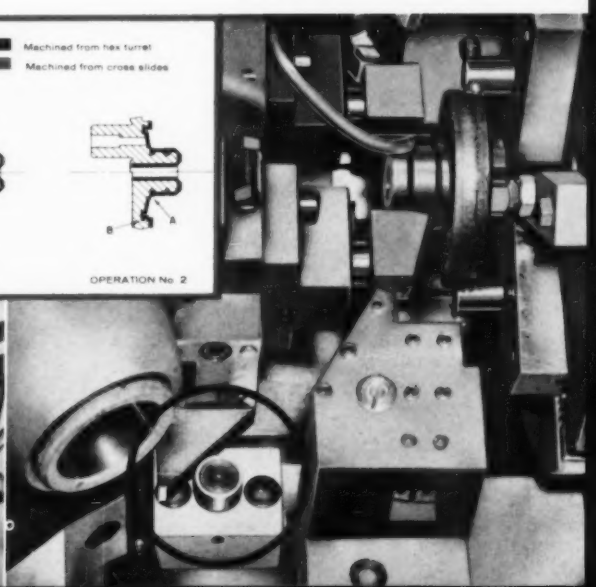
Five 1F Fastermatics replace nine older lathes. Savings include 46% less machining time, 40% less change-over time, 15% longer tool life. Surface finish is improved and closer tolerances are held. Productivity is increased, too, because the automatic machining cycle permits each operator to handle two machines.

For complete facts on 1F Fastermatics, circle No. 1751 on inquiry card.









GLOBE OIL TOOLS THREADS 580% FASTER ON 28Rc STEEL ASSEMBLIES

Are you using thread grinders, thread millers or hand-operated lathes to perform threading operations on hard materials or tough jobs? You can probably make substantial savings in original equipment and tooling costs, and improve production rates as well, with the modern CRI-DAN method. Low-cost, single-point carbide tools, easily sharpened or replaced, are used to produce all types of threads to highest accuracy and finish. Higher speeds and feeds may be used. The automatic threading cycle assures repeat accuracy and, in many cases, permits the operator to perform additional work for added savings.

One CRI-DAN "E" replaces four lathes, ups total production from 48 to 70 parts per day

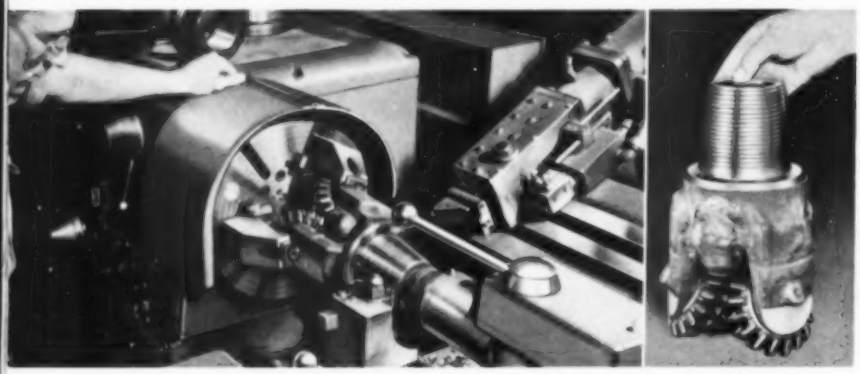
This setup at Globe Oil Tools Company, Los Nietos, California, is worth careful study. It shows you an easy way to cut costs, up production, and maintain the accuracy and fine finish you require in threading operations.

Previously, Globe Oil Tools used four engine lathes to machine the tapered threads on the pin ends of oil well rock bit assemblies. A typical, 8¾-size part is shown below.

Highly skilled men were needed to meet the accuracy and finish requirements of these hard-working parts. Production averaged 12 pieces per day, per machine, at 80% efficiency.

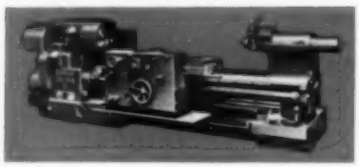
Now, with the setup shown on a CRI-DAN "E" Threading Lathe, production has increased to 70 parts per day at 80% efficiency. The automatic cycle reduced the operator's work to loading, starting the cycle, gaging, and removing the completed part. It allows him time to handle pre-threading operations on another automatic.

Work is gripped in a 3-jaw air chuck, locating against turned shoulders on each of the three segments of the welded assembly. The 4½ API, .117"-deep thread on the 8¾-size part shown is completed in 26 passes at 385 r.p.m. Tool "in-feed" is set to diminish with each pass—starting at .007" and removing only .00175" on the final pass. This assures highest accuracy and an extremely fine finish. A rear-mounted auxiliary slide bevels and faces the standoff shoulder, and relieves the threads at the large end. Threading time is 2.5 minutes.



Tough, 28Rc welded steel forging assemblies are threaded 580% faster using the CRI-DAN single-point carbide tool threading method. One CRI-DAN "E" replaces four engine lathes. CRI-DAN operator has time to handle another automatic.

For complete information on CRI-DAN "E", circle No. 2751 on inquiry card.



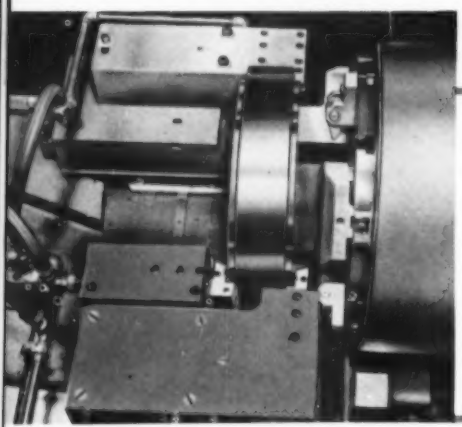
SPROUT, WALDRON & COMPANY HANDLES SMALL LOTS 400% FASTER

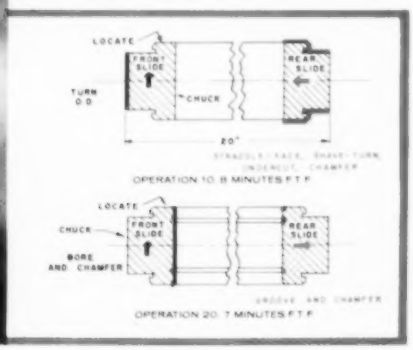
Versatile tooling, fast change-over on Simplimatic save on big parts

You may be paying premium rates to produce small lots on manual machines. Here's what happened when Sprout, Waldron & Company, Inc., Muncy, Pennsylvania, replaced two older lathes with one Gisholt MASTERLINE Simplimatic Automatic Lathe. Machining time was cut 400% on over 12 different sizes of forged steel pellet mill dies and roller shells. These are produced in lots of 20 to 100, and are used for compacting and densifying animal feeds, free-flowing plastic and chemical products.

The wide platen table of the Simplimatic provides maximum flexibility for placement of tool slides. Tools and tool blocks are designed for quick adjustment or replacement. Chuck jaw inserts accommodate different diameters. Complete change-over to different sizes on the same operation averages 20 to 25 minutes.

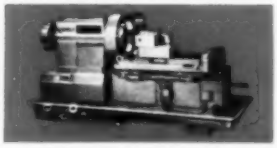
The first operation setup for a 20"-diameter, 5" Simplex die is illustrated. Note the pivoting locators on the chuck, swung aside to permit machining front and back surfaces simultaneously. Table traverse positions the tools and standard slide movement is used to machine. The line drawings show the surfaces handled by the front and rear independent slides in two operations.





Quick setup and fast cycle handle big pellet mill dies 400% faster. Simplimatic replaces two older machines—eliminates all overtime and night-shift premium for these operations. Smart tooling reduces inventory requirements. Automatic cycle permits operator to do other work for added savings.

For complete facts on Simplimatic, circle No. 3751 on inquiry card.



ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

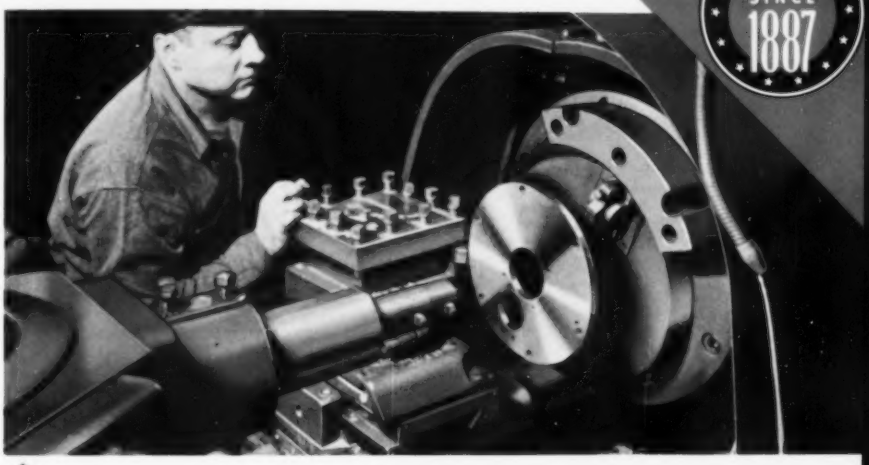
HOW YOU CAN HOLD COSTS DOWN ON SPECIAL JOBS

MASTERLINE GISHOLT SINCE 1887

Indexing fixtures on standard saddle type turret lathes combine operations for economy and accuracy

There may be a cost-cutting idea for you in the machining methods used by a well-known gear motor manufacturer. Here the problem was to reduce costs of machining housings with a wide variety of mountings, and various other component parts.

To produce such a great variety of types and sizes, this manufacturer relied on smart fixturing which allows operations to be combined on standard machines. The two setups shown here demonstrate how this approach offers improved accuracy and lower machining costs.

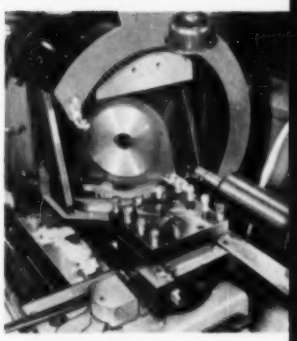


Unique fixturing on standard saddle type turret lathes handles 2-step jobs in one chucking—assuring greater accuracy and eliminating extra handling.

For complete facts on 5L Saddle Type Turret Lathes, circle No. 4751 on inquiry card.

Here a sliding type indexing fixture on a Gisholt 5L Saddle Type Turret Lathe is used for head and bearing plate assemblies. The O.D. of the 19.122"-diameter assembly shown is turned and the work is faced from the cross slide square turret. The "on-center" hole is bored from the hex turret. The operator then indexes the fixture about an eccentric axis, positioning the "off-center" hole for machining from the hex turret.

This Gisholt 5L Saddle Type Turret Lathe is tooled to face and bore four sizes of gear motor housings. The work is held in a counterbalanced faceplate fixture with an indexing base. It is faced from the cross slide square turret and finish-bored from the hex turret. It is then indexed 180° for identical machining on the reverse side. The indexing fixture eliminates extra handling and clamping. With this setup, bores are parallel within .001", and round and straight within .0005". F.t.f. times range from 27 to 47 minutes.



HOW CHRYSLER AIR TEMP BALANCES SMALL PARTS FASTER, MORE ACCURATELY

The trend to miniaturization, higher operating speeds and greater efficiency from working parts presents problems throughout manufacturing. Tolerances are especially critical in rotating parts, requiring accurate balance for long life and noise-free operation. The new Gisholt line of "HS" Bench-Type, High-Speed Balancing Machines provides a low-cost answer.

New Gisholt "HSV" (High-Speed Vertical) Balancer handles wide variety of small blower and fan wheels

The blower fans and wheels shown are typical of those used in automotive defroster and heating units produced by Chrysler Corporation's Air Temp plant in Dayton, Ohio. Light weight and operating speeds up to 4400 r.p.m. demand extremely accurate single-plane balancing.

The setup shown, on a Gisholt "HSV" Balancer, provided all the answers. Accuracy requirements were easily met since the machine clearly shows the angle and amount of unbalance causing vibrations as small as .000002". Over-all balancing time was cut 50%. Setup was also speeded. Tooling costs were reduced by using simple adapters to locate work, and setscrews to hold and drive.

The defroster blower wheel shown on the machine is typical. It is 3¼" in diameter and weighs four ounces. The strobe lamp indicates the exact angle of unbalance on a graduated disc that rotates with the work and adapter. A direct-reading amount meter, in the same visual plane, shows the correct-weight aluminum clip that must be "crimped" to the vane to balance within tolerance. Since the amount of unbalance is shown in *terms of the correction method used*, there is no need for a second rotation for inspection. Production is 60 or more pieces per hour at 80% efficiency.

New "HSV" Balancer cuts time 50% on this job...assures accuracy on small, lightweight, high-speed parts. Both vertical and horizontal "HS" Balancers are available. Belt-, air- or electrically self-driven parts or assemblies containing high-speed rotating parts may be handled. This includes miniature armatures, aircraft and missile gyros, small spindles, turbines, textile parts, etc.

For complete information, contact your Gisholt Representative or circle No. 5751 on inquiry card.

GISHOLT

MACHINES WITH NEW MACHINE GUARANTEE

MASTERLINE GISHOLT SINCE 1887

HOW POWERS REGULATOR CO. IMPROVES DIMENSIONAL CONTROL ON VALVE BODIES

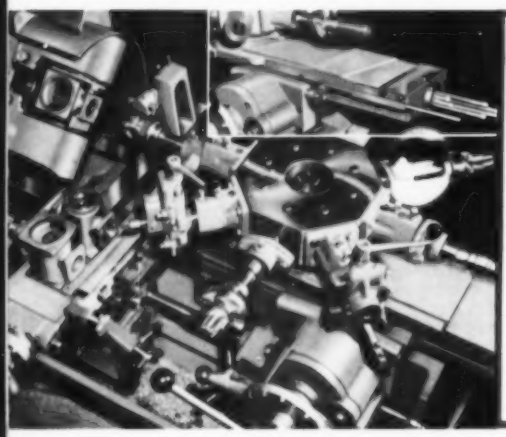
No. 5 Ram with indexing chuck and auxiliary stop completes four ends per chucking

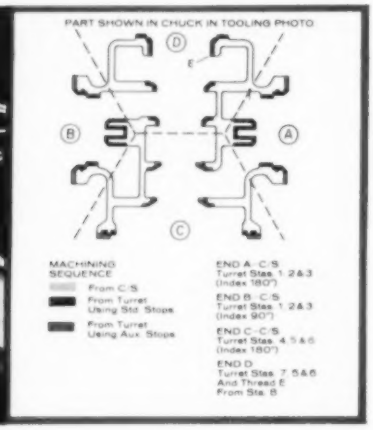
If your work involves tees, ells or crosses, you'll get some cost-cutting ideas from this setup, used by Powers Regulator Company, Skokie, Illinois. It assures concentricity, parallelism and highest accuracy by completing all four ends of brass valve bodies in one chucking.

The basic setup on a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe, shown below, handles three different sizes of parts. Four factors are responsible for improved dimensional control and reduced time on this job:

1) A 15", 2-jaw, air-operated, indexing chuck—that completes all four ends in one chucking.
2) An Octagon turret—with hollow mills and multi-diameter cutters to machine maximum surfaces per pass.
3) A retractable auxiliary stop for the turret ram, shown inset. Despite eight turret stations, all surfaces could not be completed. The answer—the standard ram stop roll to control length of cut on one end—an auxiliary stop to control length of cut on the opposite end—on stations 5 and 6.
4) "Tenth" indicator for speedy cross-slide setting.

The drawing and machining sequence data, left, shows how the special tooling is used. F.t.f. time on the part shown is 9.8 minutes.




PART SHOWN IN CHUCK IN TOOLING PHOTO
D
E
B
A
C
MACHINING SEQUENCE
From C:S.
From Turret Using Std. Stops
From Turret Using Aux. Stops
END A C:S. Turret Stas. 1, 2 & 3 (Index 180°)
END B C:S. Turret Stas. 1, 2 & 3 (Index 90°)
END C C:S. Turret Stas. 4, 5 & 6 (Index 180°)
END D Turret Stas. 7, 5 & 6 And Thread E From Sta. 8

If you are handling similar work, with two or more ends to be machined, circle No. 6731 on Inquiry Card for information on the Gisholt MASTERLINE Ram Type Turret Lathe and Gisholt Indexing Chucks.

THOMPSON RAMO WOOLDRIDGE INC. CUTS FINISHING TIME, IMPROVES QUALITY ON GEARS

Superfinish corrects part geometry, provides smoother surface for greater operating efficiency

Looking for an economical way to obtain flatter, smoother, longer-lasting wear surfaces? Then study this Superfinishing setup used by Thompson Ramo Wooldridge Inc., Fuel Systems Works, Tapco plant, Cleveland, Ohio.

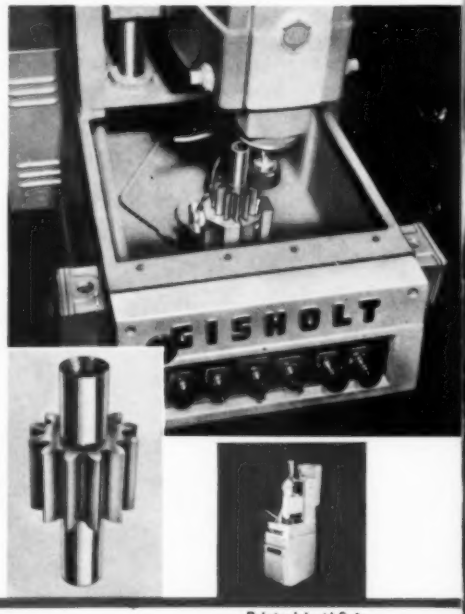
The workpiece, an aircraft fuel pump gear, is used to pump kerosene and gasoline. It requires a very flat, low micro-inch surface finish for most efficient operation. Here's how a Gisholt MASTERLINE Model 81 Superfinisher meets this requirement economically on four gear sizes.

Work is placed in a special fixture against an adjustable stop. On engaging the stop, the workpiece is given a counterclockwise turn to lock it in the fixture. The Superfinishing stone is then engaged. Stone pressure holds the work securely during the operation.

The work and the Superfinishing stone rotate in opposite directions. Some stock is removed during Superfinishing to correct surface geometry and provide the required flat face. Surface roughness is reduced to a "controlled" 1.5 micro-inches R.M.S. Cycle time for one face of the work is 1.5 minutes. To Superfinish the opposite face, the operator removes the part by twisting it clockwise, turning it end for end and repeating the operation. Total time for both faces is three minutes, f.t.f.

Superfinish eliminates grinding defects, improves surface geometry, exposes true base metal for longer surface life. Fixture permits completing both pump gear faces to required accuracy in minimum time.

For complete facts on Model 81 Superfinisher, circle No. 7731 on inquiry card.



No. 11-1259
751

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Lathes • Packaging Machines • Masterglas Molded Plastic Products

A PRODUCT *OF SKILL*

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100%
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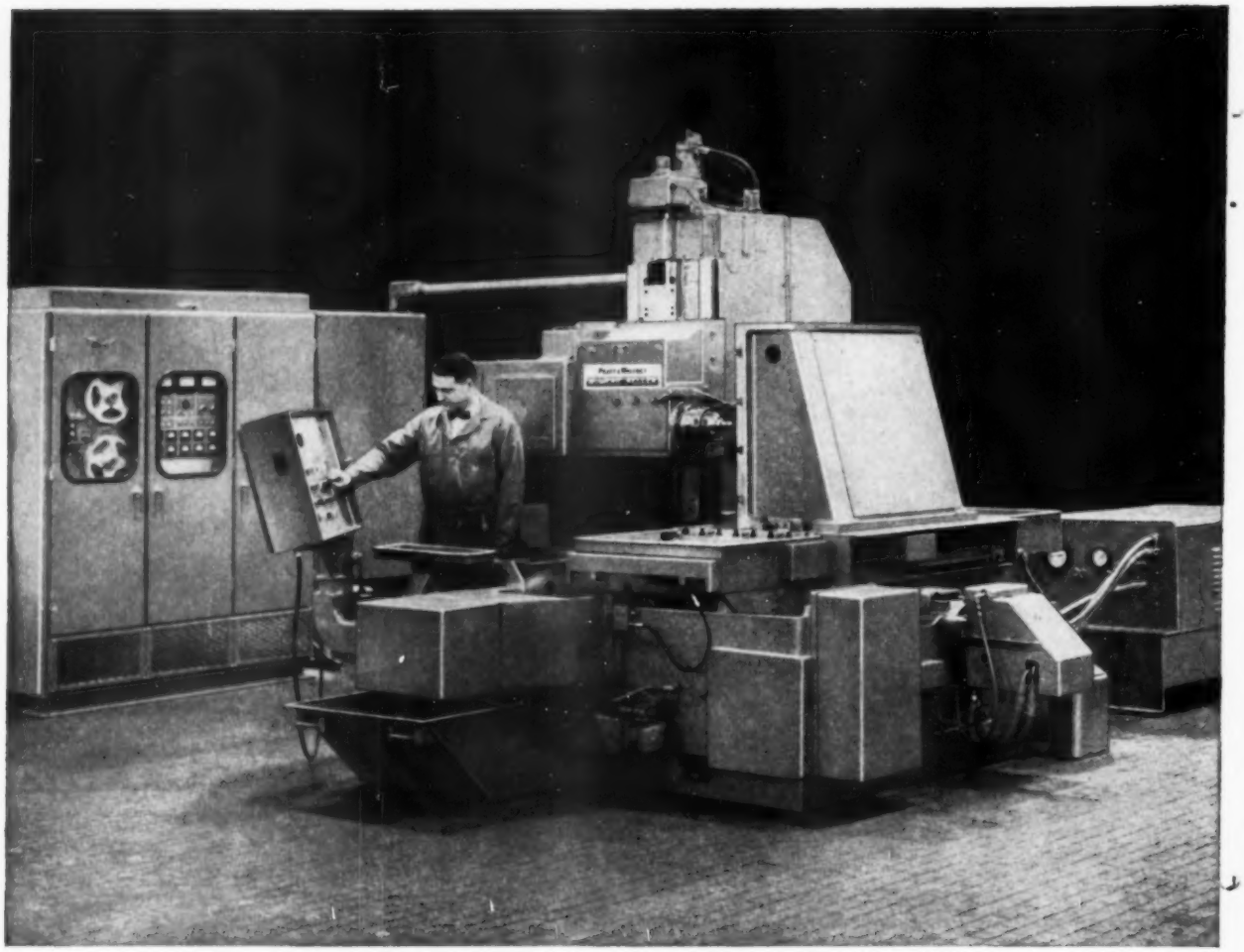
Skill-produced Butterfield drills, reamers, taps, dies, counterbores, cutters, end mills, hobs and carbide tools are as close as your phone. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. **Call your Butterfield Distributor.**

BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

ACCURACY



PER-PIECE PRODUCTION TIME CUT 33% . . . by machining these aluminum computer housings on a Numeric-Keller. Each piece required 12 pockets milled and 72 holes drilled. Scrap loss to date: zero!

ONLY 21.5 HOURS . . . were needed to machine this complicated tool steel missile part on a Numeric-Keller. Machining involved 3 roughing and finishing contour cuts and 4 roughing and finishing pocket milling cuts.

3-DIMENSIONAL MILLING UNDER TAPE CONTROL . . . is demonstrated by this vision block for a super-modern military tank. Geometry is quite complex. Tape was prepared using both computer and hand computations.

ASSURED...

...PLUS REVOLUTIONARY ADVANCES IN MACHINING SPEED, EFFICIENCY and VERSATILITY with the new

NUMERIC KELLER

TOOLING COSTS and LEAD TIME CUT AS MUCH AS 75% . . . because the P&W Numeric-Keller is equipped for continuous-path milling under the direction of a tape-reading numerical control system. Models, templates and other costly, complicated tooling are eliminated!

EXTREME ACCURACY . . . with overall production easily held to ± .001". Piece-to-piece reproduction accurate to "tenths" is possible with controlled cutter selection.

UNUSUAL VERSATILITY . . . with more different types of jobs done faster and better. Short and long runs are handled with equal efficiency. Using tape, changeover is fast and easy, with minimum time lost between jobs.

MACHINE UTILIZATION IS GREATLY INCREASED . . . because more time is spent making chips, with less time needed for setup, fixturing and other non-productive operations. Similarly, man-hours are made more productive.

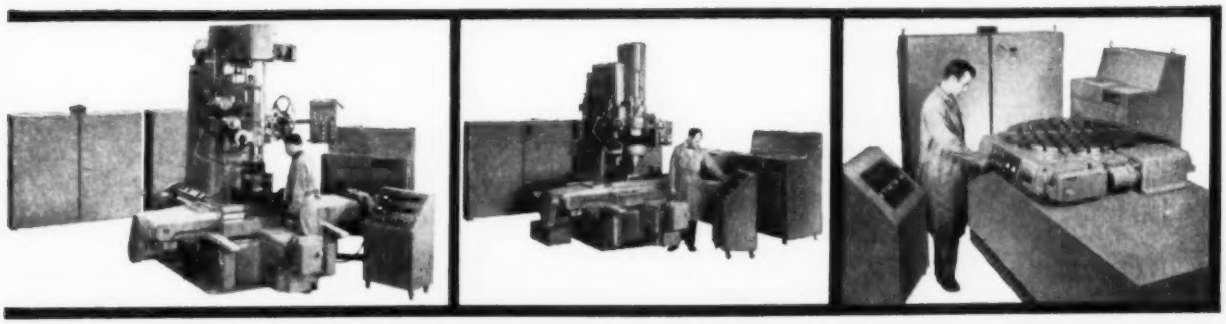
MACHINING TIME IS SLASHED . . . because tape control means maximum speeds and feeds programmed through all phases of the machining cycle. Optimum machining practice at all times also means finer surface finishes.

SEND NOW FOR THE CASE-HISTORY FACTS . . . that show how the P&W Numeric-Keller has saved *HOURS* of setup, tooling and machining time on dozens of jobs like the 3 examples shown on the facing page. See how this revolutionary machine can produce equally important savings on the toughest milling jobs in YOUR plant. Write today for your copy of Circular No. 624, that includes Job Analysis Sheets to give you the dollars-and-cents facts on Numeric-Keller savings. Pratt & Whitney Company, Inc., 11 Charter Oak Blvd., West Hartford, Connecticut.

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS



OTHER P&W NUMERICALLY CONTROLLED MACHINE TOOLS . . . include the Jig Borer, Vertical Precision Hole Grinder, and Precision Rotary Tables. Providing settings accurate to .0001", made automatically from data supplied by punched tape or operator keyboard, the Jig Borer and Hole Grinder combine toolroom precision with production-line speed and ease of operation. Equally efficient for short- or long-run production work. Ultimate in speed plus precision in circular spacing, graduating, and angular positioning, the Pratt & Whitney Numerically Controlled Rotary Table provides automatic settings accurate to 5 seconds of arc!

Announcing ...a fully-automatic precision DRILL POINTER

the

Model 100 WINSLO-MATIC DRILL POINTER

THE ONLY DRILL POINT GRINDING MACHINE WITH ALL OF THESE OUTSTANDING FEATURES AND ADVANTAGES

- FULLY-AUTOMATIC CYCLE — INCLUDING EJECTION OF DRILLS
- WILL GENERATE HELICAL OR CONVENTIONAL POINTS
- DRILL POINTS CONCENTRIC WITHIN .0002
- HIGH PRODUCTION RATE — CYCLES IN 3 SECONDS
- PACESETTER ADJUSTER SETS INTERVAL BETWEEN CYCLES
- LOCATES ON THE POINT — NO ADJUSTMENTS REQUIRED FOR VARIATIONS IN DRILL LENGTHS
- FULLY AUTOMATIC SELF-COMPENSATING WHEEL DRESSER

Here is one of the most sensational machines ever to be introduced to industry! The Model 100 WINSLO-MATIC DRILL POINTER produces *automatically and with extreme precision,* the Winslow Type 4 drill points or other helical (self-centering) points, as well as conventional points. And in addition, the drill point on most drill countersinks can be sharpened with this machine.

Forms are generated by means of a combination of 2 cam movements. The drill point angle is formed on a 20" diameter grinding wheel. The number of drills pointed between automatic dressings is pre-determined by a selector switch. The WINSLO-MATIC DRILL POINTER operates on a single source of power (electrical). Grinding wheel and work-head are well guarded to retain coolant and spray, assuring a clean, anti-splash operation. Unit occupies only 36" x 48" floor space. Work-head is at convenient level for maximum ease of operation.

No other machine can match the precision, production and labor-saving advantages of the revolutionary WINSLO-MATIC DRILL POINTER. Write for full details today!

WRITE TODAY
... for WINSLO-MATIC DRILL POINTER Bulletin and name of your nearest dealer.

Winslow PRODUCT ENGINEERING CORPORATION
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Manufacturers of power hand tools and accessories for the nation's aircraft and manufacturing plants.

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SPACEMATIC DRILL MOTOR
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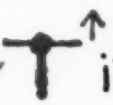
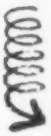
NUTPLATE DRILL MOTOR
A portable power tool used on Nutplate installations.

SPACEMITE DRILL MOTOR
A heavy-duty tool that replaces angle drills for limited-access-area drilling.

If it rolls on an axle or turns in a bearing or rides on a shaft if it slides in a groove or moves on a pivot  if it bores  or cuts or transmits pressure one of Sinclair's 500 specialized lubricants is designed to make it work better. For answers to your lubrication problems, write today to

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Technical Service Division
600 Fifth Ave., N.Y. 20 N.Y.

Sinclair

AIRCO'S NEW HI-LO CONTROL FOR MACHINE TORCHES

gives you substantial gas savings

IT SAVES GAS BECAUSE YOU CAN GET

- *proper preheat flow for starting a cut*
- *minimum flow for balance of cut*

The Duplex HI-LO Control enables the flame cutting machine operator to vary preheat oxygen and fuel gas during the cutting operation . . . from a heavy preheat at the start to a lighter preheat once the cut is underway. Less oxygen and fuel gas are consumed.

Additional bonuses are faster starts and quality cuts free from melted-down edges and warpage.

The Duplex HI-LO is simple to operate, and moderate in cost. A Single HI-LO is also available for adjusting preheat oxygen only when low pressure fuel gas is used with injector-type torches. Both can be used with all Airco flame cutting machines.

For more information, call your nearest Airco district office or authorized Airco dealer. They are listed in the Yellow Pages under "Welding Equipment and Supplies."

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Brown & Sharpe

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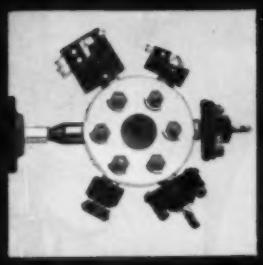
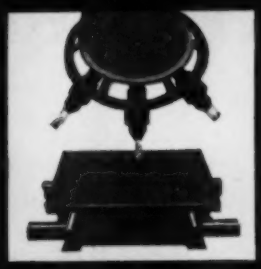
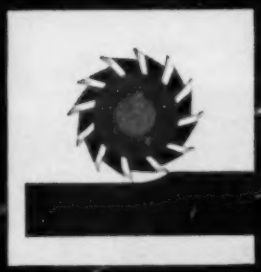
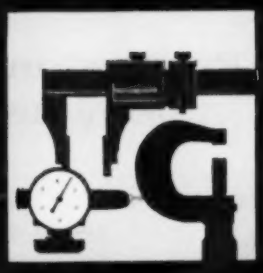
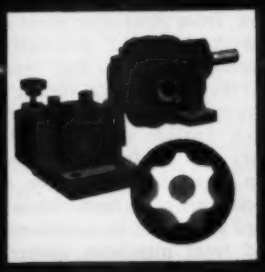


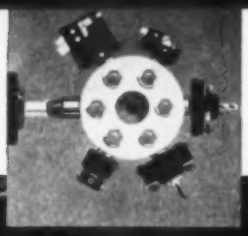








to help you
make more
for less . . .



TO HELP YOU REDUCE SCREW MACHINE PRODUCTION COSTS

Production records prove the new Brown & Sharpe Automatics pay off predicted savings - with a plus

B-1113 STEEL

49% SAVING
in production time

With previous equipment	With new No. 2 Automatic
34½* Sec. per piece	17½

*Includes 22½ sec. for secondary operations which are now part of No. 2 Automatic machining cycle.

B-1113 STEEL

54% SAVING
in production time

With previous equipment	With new No. 2 Automatic
57¼* Sec. per piece	22½

*Includes 2¼ sec. for secondary operation which is now part of No. 2 Automatic machining cycle.

Now, from plant after plant where the new B&S No. 2 Automatic Screw Machines are in the line, reports show that they not only deliver the promised advantage over old equipment, but often provide a substantial plus in extra savings. In many cases — one, two, and sometimes three secondary operations have been eliminated. The need for the extra machines is ended, and total man-hour savings run as high as 90%.

In addition, the new Automatics maintain specified tolerances as close as 0.0005", and meet the highest standards for surface quality.

With such proved production savings, buyers agree that the new Automatics "pay for themselves in record time." Find out how you can make comparable savings with the extra speed and precision — the extra adaptability for combined operations — the faster set-ups and extended tool life.

The No. 2 Automatic is made in 3 sizes — to take stock up to ¾", 1¼", and 1½" diameter. For complete details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

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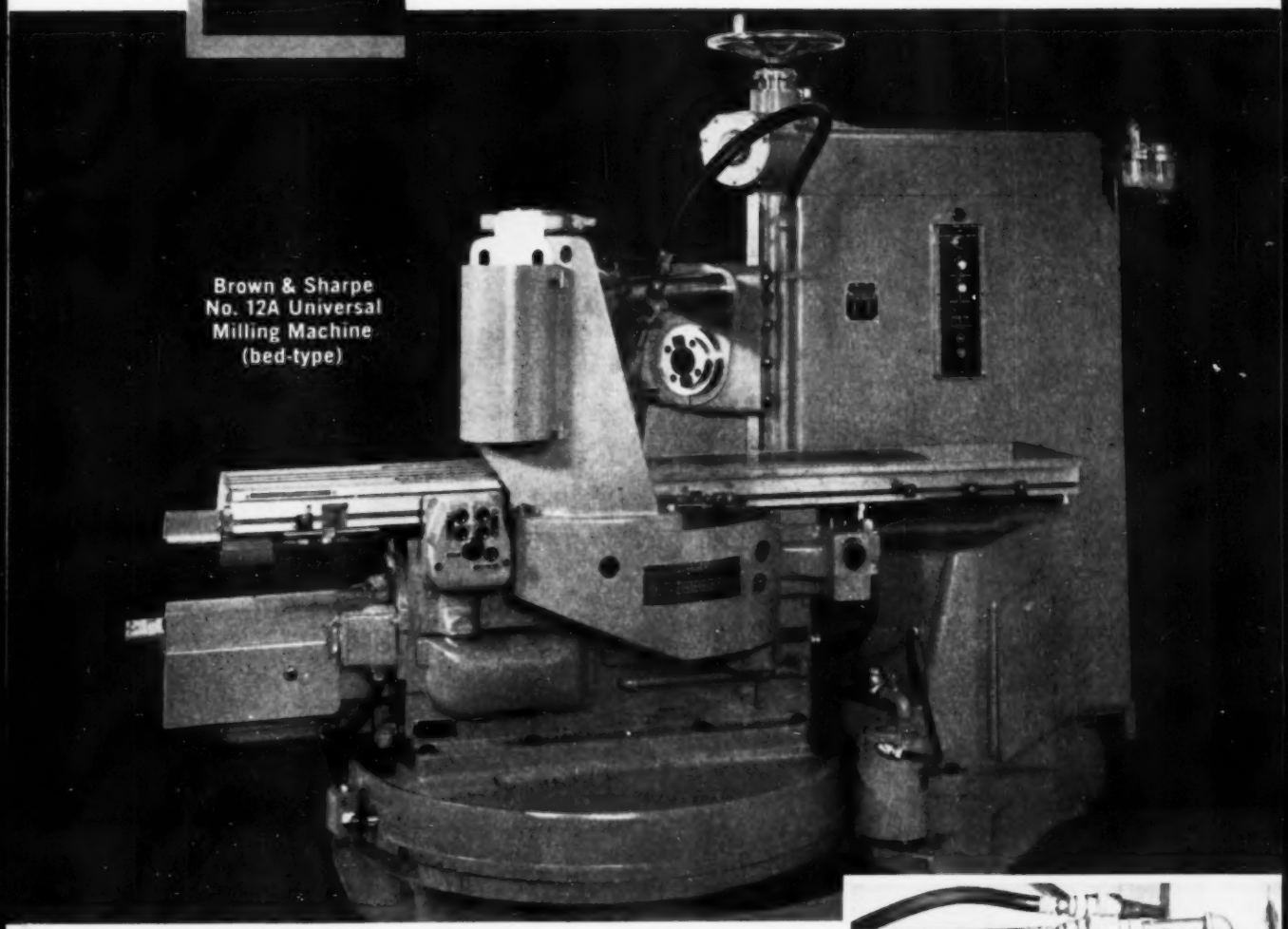
TO HELP YOU MILL MORE FOR LESS



Brown & Sharpe
No. 12A Universal
Milling Machine
(bed-type)

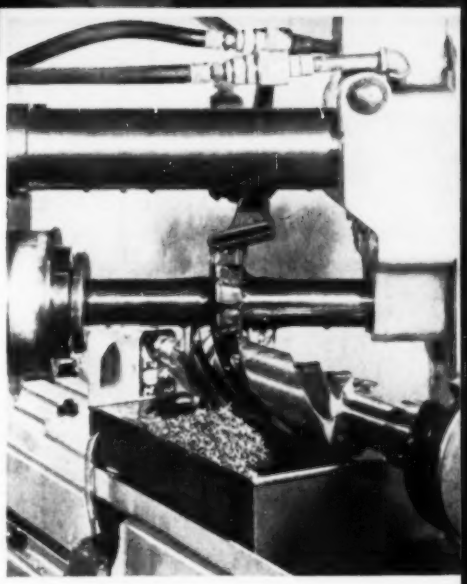
NOW—helical milling with automatic production economy

The No. 12A Universal combines a unique swiveling base arrangement with the powerful cutting ability and automatic control features of the popular Brown & Sharpe bed-type milling machines. Developed for helical milling of cutters, drills, reamers, and similar work, it provides big savings in production costs over knee-type Universals designed for small-lot operations.

Control operations are automatic, freeing operator for other duties after work piece has been loaded and machine started. Automatic operations include separation of cutter and work to provide necessary clearance required for the run back in helical milling.

Cutting feeds more than double those practical on knee-type machines have been used for work transferred to the No. 12A, and surface quality improved. The rugged bed-type construction and full bearing support of the table ways, and the rigid arbor support provide ideal conditions for the heaviest cutting loads.

For complete information on all the cost-saving advantages of the No. 12A Universal, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.



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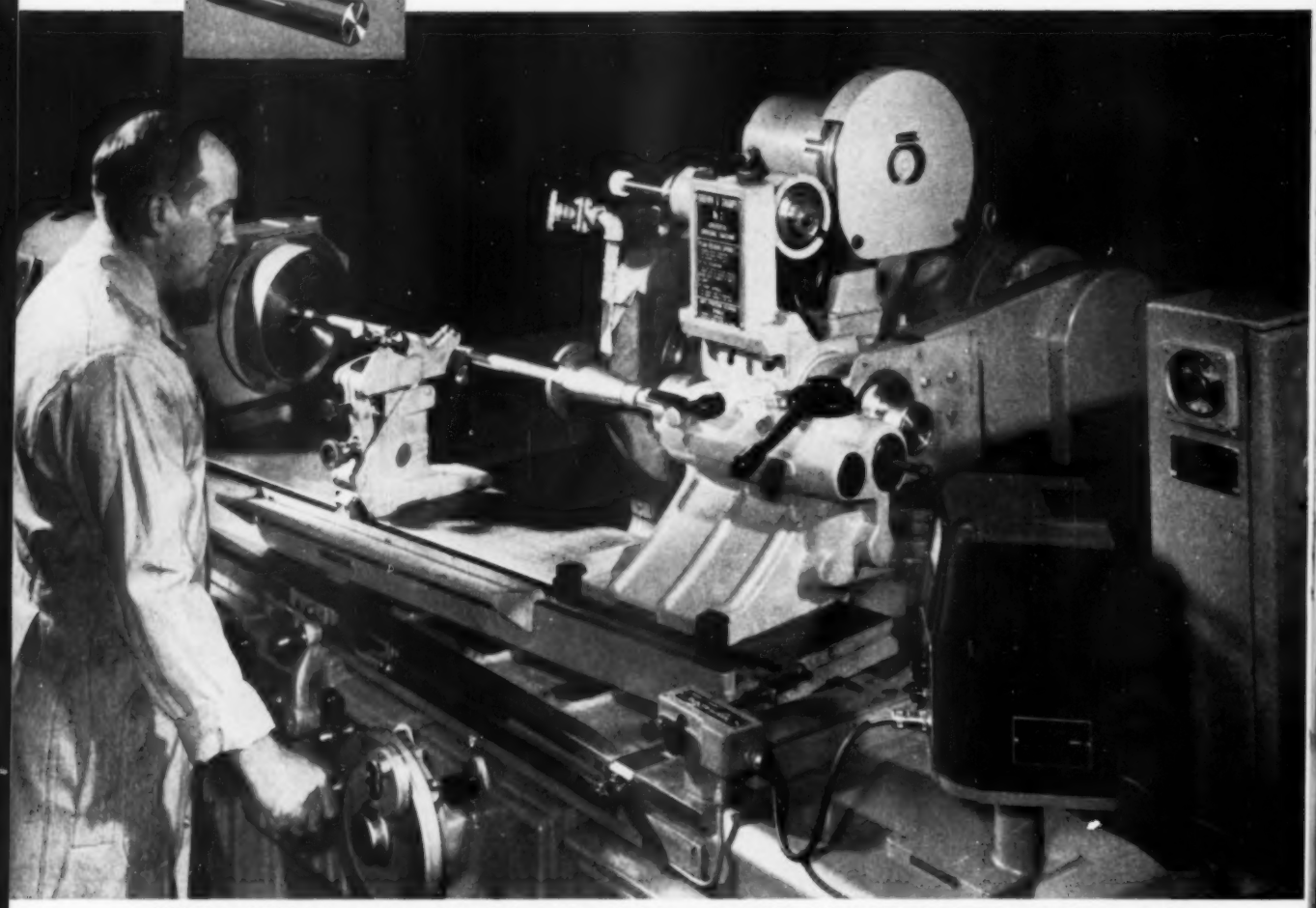
TO HELP YOU GRIND MORE FOR LESS



BROWN & SHARPE design for dependable grinding economy includes . . . Completely Universal Wheel Spindle Head on Turret — Set Diamond Wheel-truing Attachment for Internal Grinding — Power and Hand Cross Feed in Both Directions — Power Cross Feed Continuous to Finish Diameter Setting — Positive Stop for both Internal and External Grinding — ELECTRALIGN for Instant Table Alignment.

Universals that deliver more grinding minutes per man-hour - save up to 75% in floor-to-floor time

Brown & Sharpe Universal Grinding Machines provide many exclusive advantages that simplify the operator's task, save set-up time, and speed up non-grinding motions. Job time saved often totals 75% or more.

Only Brown & Sharpe offers the ELECTRALIGN®, the original electronic indicator for swivel table alignment — the only device that permits instant alignment to 10 millionths per inch of workpiece with a single setting. The operator is fully relieved of the need for calculations. No delay for repeated gaging and adjustment, and no scrap.

For top returns in cost-reduction, you need all the extra advantages of Brown & Sharpe design when you choose grinding machines for toolroom, prototype operations, or for production grinding. Why settle for less? Four machine sizes. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

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TURRET DRILLING MACHINES...
TO HELP YOU DRILL MORE FOR LESS

AT MINNEAPOLIS-HONEYWELL, BROWN INSTRUMENTS DIVISION, Philadelphia, six Model A B&S Turret Drilling Machines are used for a wide variety of drilling, tapping, boring, and reaming operations — permit 2 to 5 times faster production than with box-jig gang drill methods. In the typical part (below), the casting is cut away to show the 10-micro finish of the holes reamed at the top.

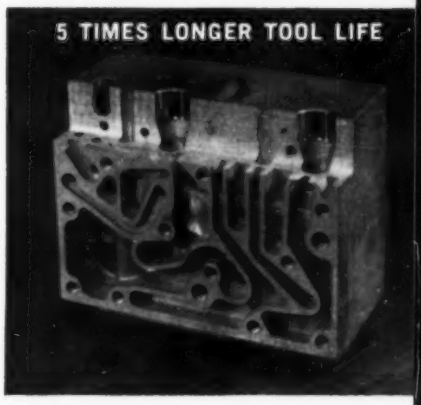
Reaming to 10-micro finish with carbide tooling on Brown & Sharpe Turret Drilling Machines

Machining complex die castings of No. 13 aluminum for a Minneapolis-Honeywell industrial process instrument was a "tool-killer" when the conventional method of box jigs on gang drill presses was used. For combination reaming of 2-diameter holes cored in the casting, a carbide reamer was tried, but the percentage of rejects remained high, and a tool-life of only 100 pieces made tool costs prohibitive.

The job was transferred to a Model A B&S Turret Drilling Machine equipped with a B&S Positioning Table and a simple work-holding device in place of the box jig. Using the same carbide reamer without guide bushings, rejects were virtually eliminated, a 10-micro finish was consistently maintained, and tool-life increased to over 500 pieces.

The B&S Turret Drilling method assures all conditions essential to successful use of carbide tooling — accurate work positioning, rigidity, proper spindle speed, easy chip removal, and ample coolant supply.

Find out how you can use Brown & Sharpe Turret Drilling to save handling time, set-up time, jig costs, capital investment, floor space and maintenance. Write for complete information. Brown & Sharpe Mfg. Co., Turret Drilling Machine Division, 20 Fitch St., East Norwalk, Conn.



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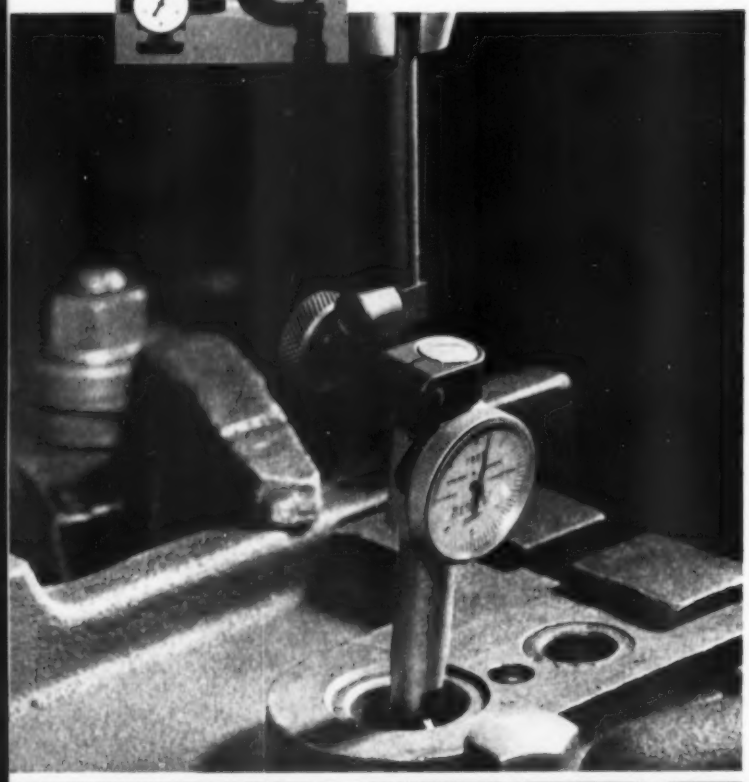
TO HELP YOU MAKE PRECISION MEASUREMENTS EASIER AND FASTER...



Precision Tool News

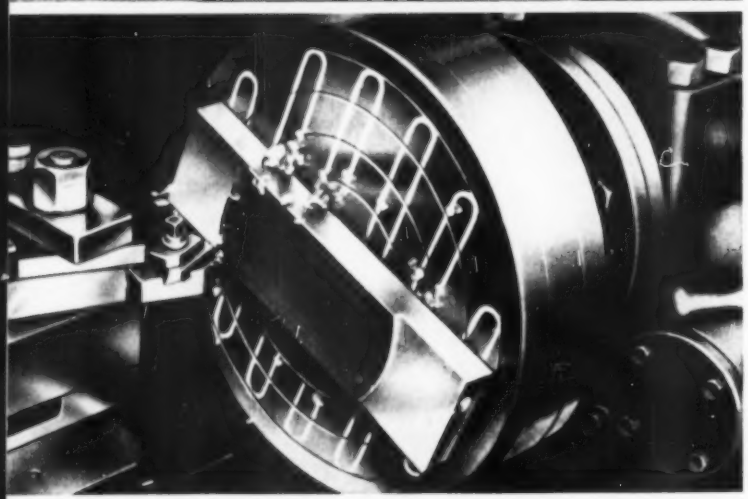
Compact new test indicator works in tight places, reads in .0001″

You can take measurements in *closer quarters* with Brown & Sharpe's little 7027 "Bestest" dial test indicator. Its $1\frac{9}{16}$″ long stem is only $\frac{3}{8}$″ in diameter.

And you'll get more *accurate* measurements, too. The 7027 has a fully-jeweled movement; the dial reads directly in ten thousandths; it is extremely repetitive.

Other features: Small lever reverses contact point direction at a touch; new friction adjustment compensates for wear of point bearings; chrome finish throughout; easy-to-read dial.

The B&S 7027 Bestest Indicator is available with .040″, .080″ and .120″ contact points, plus accessories for use with all rigid-type B&S holding devices — or with .080″ point and one bar only (for 12″ Vernier Height Gages) — in a handsome hinged-cover wooden case.



New B&S Rotary Magnet Chucks are powerful enough for turning operations

Brown & Sharpe's new rotary permanent magnet chucks are so powerful that you can actually use them for substantial cuts on lathes, boring, and other metalworking machines. They have 25% to 75% greater holding power than previous types — are lighter and thinner — have circular rings that help centering, too. Available in 4¼″-, 6½″-, 9″-, and 12″- diameter sizes. They are also ideal for grinding operations.

B&S Black Granite Thrift Surface Plates available at new low cost

To get famous Brown & Sharpe Black Granite Surface Plates at lowest cost — choose from this no-ledge "Thrift" line. You get surface accuracy of 100 millionths, in a low-cost plate that will outwear metal and ordinary granite plates. Stock sizes from 12″ x 18″ to 48″ x 144″ — Specials to suit any need. (Brown & Sharpe recently furnished one special that measured 6′ x 16′ in one piece.)

Call your B&S Distributor!

He's *nearby* . . . He can make *prompt delivery* of B&S tools from local stocks . . . He's ready, willing and able to *help you*. Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

INDUSTRIAL DISTRIBUTORS THE RIGHT HAND OF PRODUCTION

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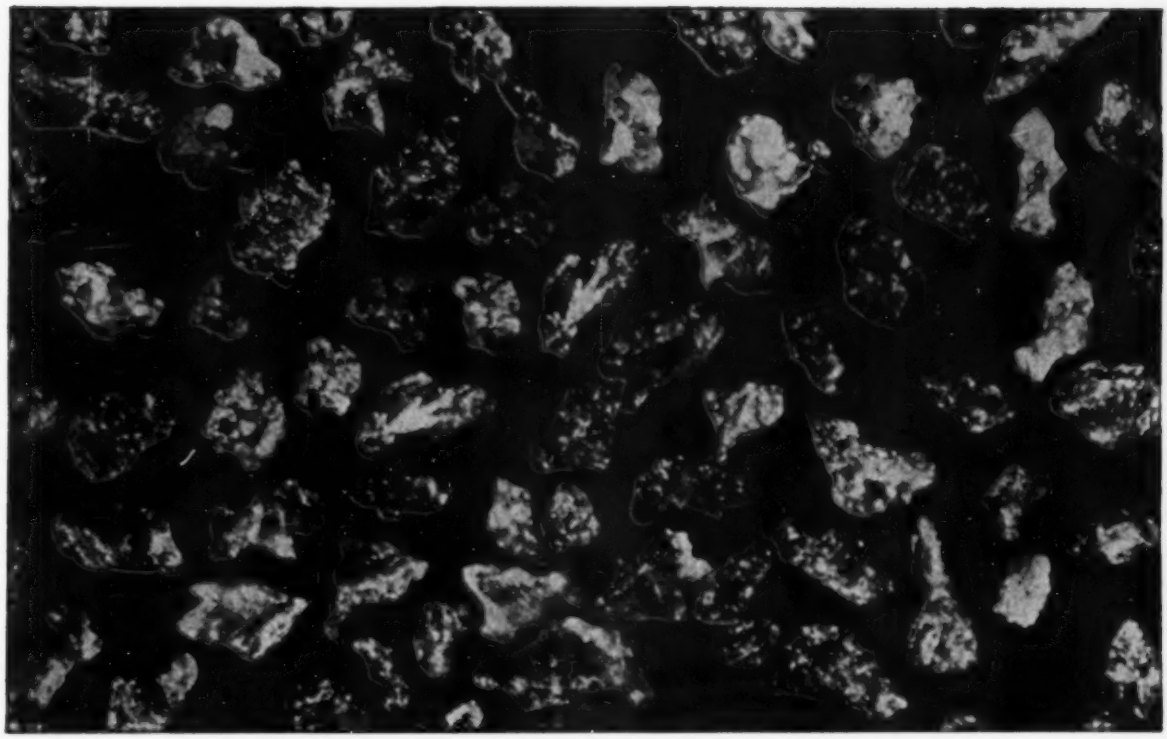
Metallurgical Memo from General Electric



How G-E Man-Made Diamonds perform where it counts: in the plant

Grinding wheel users report on actual production results with Man-Made diamonds. Findings: substantial savings in every case!

General Electric Man-Made industrial diamonds—through actual customer "in-plant" comparisons are saving thousands of dollars in diamond grinding wheels. Here's proof:

A saw manufacturer using $3\frac{3}{4}$" x $1\frac{1}{2}$" x $1\frac{1}{4}$" flaring cup wheels to sharpen carbide saws. Wet grinding with 120 grit, 100 concentration, resinoid bonded wheels. The natural diamond wheel removed only 9 cubic inches of carbide. The G-E Man-Made diamond wheel removed 34.8 cubic inches of carbide—a superiority of Man-Made over natural of 290%!

An automobile manufacturer's results on tool and cutter sharpening with 5" x $1\frac{3}{4}$" x $1\frac{1}{4}$" flaring cup wheels. Dry grinding with 100 grit, 100 concentration, resinoid bonded wheels. The natural diamond wheel sharpened 696 cutters. The Man-Made diamond wheel sharpened 1217 cutters *and still had one-third of the wheel left*—a measured superiority of 162% in favor of G-E Man-Made industrial diamonds.

A carbide manufacturer using 16" x 2" x 12" wheels for cylindrical grinding. Wet grinding with 120 grit, 100 concentration, vitrified bonded wheels. Natural diamond wheel removed 928 cubic inches of carbide . . . Man-Made diamond wheel removed 1510 cubic inches. G-E Man-Made diamond superiority of 63%!

These examples, with results typical of those found in many other applications, emphasize the superiority of General Electric Man-Made industrial diamonds. Regardless of the wheel type, G-E Man-Made diamonds are saving diamond wheel users valuable production dollars today because wheels using Man-Made diamonds last longer. Specify G-E Man-Made diamonds when you order diamond wheels and prove in your own plant the savings possible on grinding and cutting costs.

Want more information? Write: *Metallurgical Products Department of General Electric Company, 11149 E. 8 Mile Road, Detroit 32, Michigan.*

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMONDS • MAGNETIC MATERIALS • THERMISTORS • THYRITE® • VACUUM-MELTED ALLOYS

In 1946 J. Gordon Lippincott and Walter Margulies began what has proved to be one of the nation's most successful industrial design firms. Here their firm has chosen the new, exciting patterns of Sharonart* as the material for their advanced design room air conditioners.

Eliminating the conventional box-like unit Lippincott & Margulies have taken advantage of the principle of thermoelectric refrigeration and the beauty of Sharonart* to design units that are both attractive and functional. Fans, housed in the base or back of these units, force air over the cooling elements and circulate it throughout the room. Housings of perforated and painted or plated Sharonart* give the units added beauty while practically eliminating wear.

Tomorrow's room air conditioners designed by Lippincott and Margulies with SHARONART*

Patterned Steel

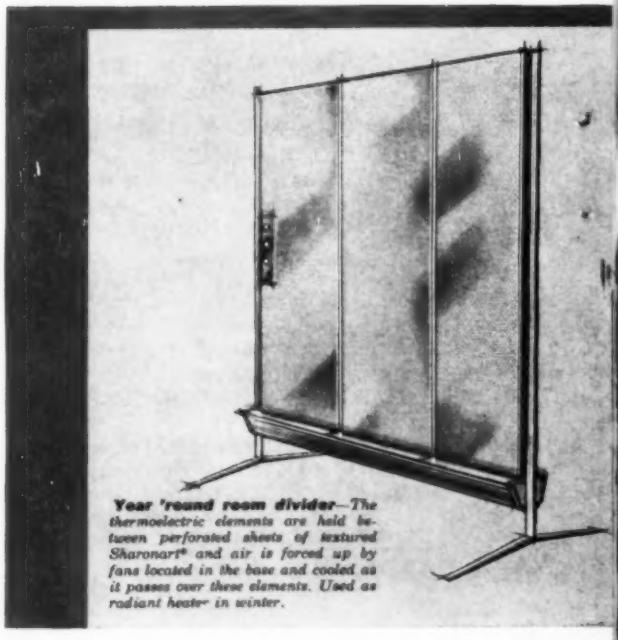
Sharonart* . . . the greatest advance in design steels in a decade . . . brings unequalled versatility to product engineers. Virtually any pattern can be rolled into one or both surfaces of stainless or carbon steels. It can then be fabricated as easily as plain steel . . . perforated, drawn, roll formed, stamped with few limitations. It can be painted, plated or coated by standard methods.

Here's new beauty, new style for your product without expensive retooling. Here's the ideal material for wear areas for most Sharonart* patterns hide scratches, fingermarks, etc.

Sharonart* is available in big production coils in a wide range of gauges and widths. Get the complete story, write for literature today.

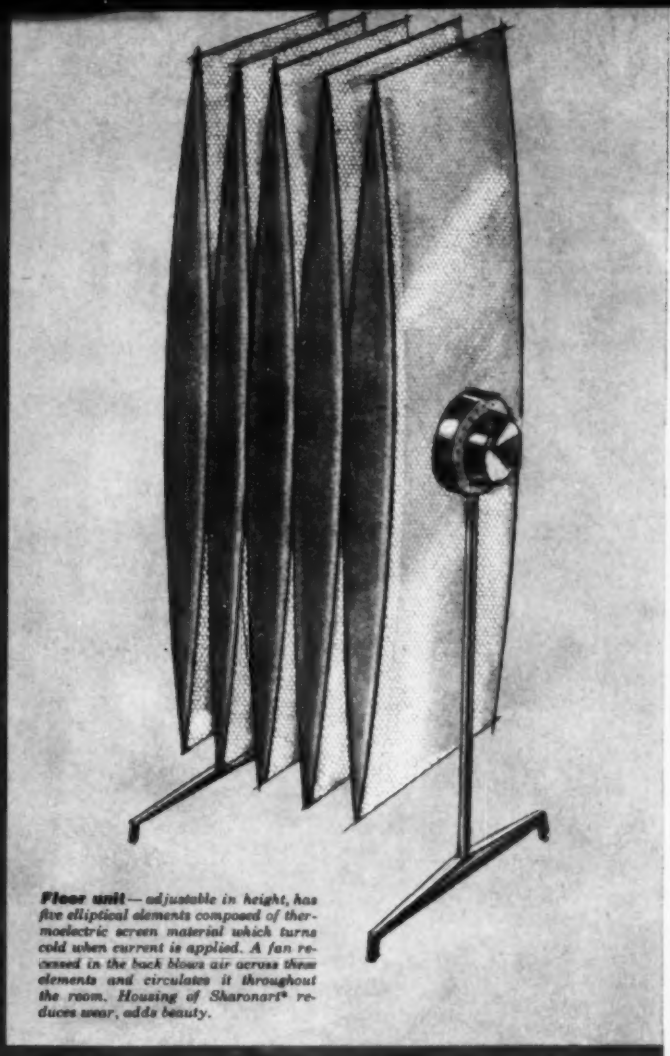
Sharon Steel Corporation, Sharon, Pa.

*TM



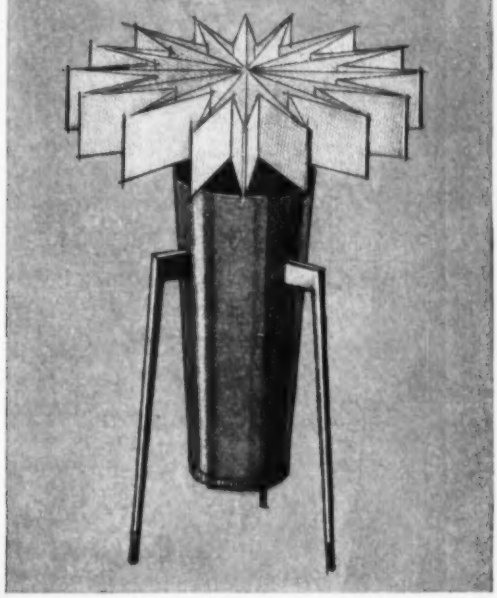
Year 'round room divider—*The thermoelectric elements are held between perforated sheets of textured Sharonart* and air is forced up by fans located in the base and cooled as it passes over these elements. Used as radiant heater in winter.*

SHARONSTEEL **SHARON** *Quality* **STEEL**



Floor unit—*adjustable in height, has five elliptical elements composed of thermoelectric screen material which turns cold when current is applied. A fan recessed in the back blows air across these elements and circulates it throughout the room. Housing of Sharonart® reduces wear, adds beauty.*

Portable unit—*Star shaped form on top is the refrigeration element and air is forced up by a centrifugal fan located in the base of the unit. Sharonart® is used in both inner and ring.*



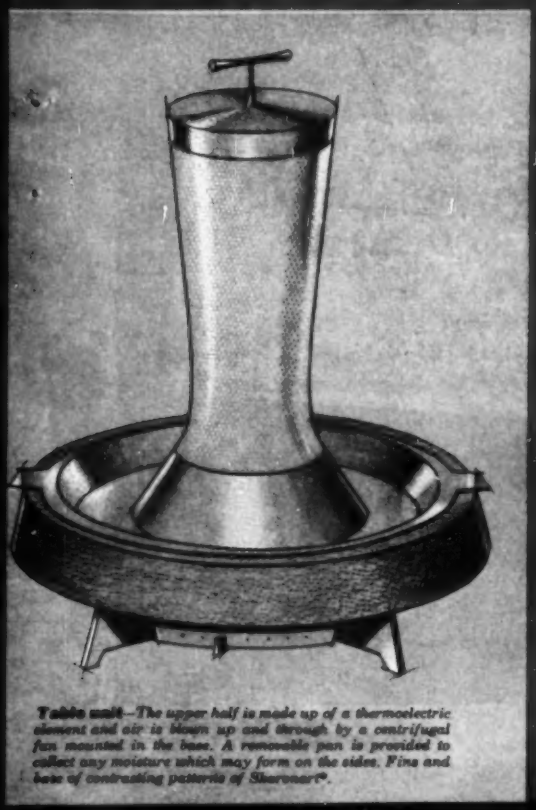
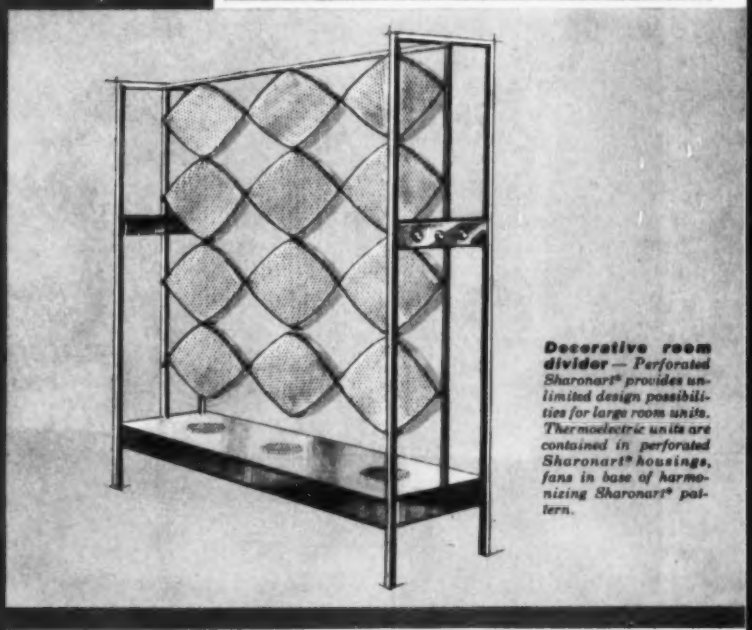


Table unit—*The upper half is made up of a thermoelectric element and air is blown up and through by a centrifugal fan mounted in the base. A removable pan is provided to collect any moisture which may form on the sides. Fins and base of contrasting patterns of Sharonart®.*



Decorative room divider—*Perforated Sharonart® provides unlimited design possibilities for large room units. Thermoelectric units are contained in perforated Sharonart® housings, fans in base of harmonizing Sharonart® pattern.*

NEW HAMPSHIRE BALL BEARINGS, INC.
PETERBOROUGH - NEW HAMPSHIRE

ARTHUR N. DANIELS
PRESIDENT

July 13, 1959

Mr. N. A. Leyds, General Manager
Bryant Chucking Grinder Company
Springfield, Vermont

Dear Mr. Leyds:

It is a pleasure to congratulate you for your Company's development of the new miniature Centalign internal grinders, from our point of view the outstanding machine tool design of the past ten years.

I feel that your engineers, designers, production people and those who made this decision are to be highly commended for this achievement.

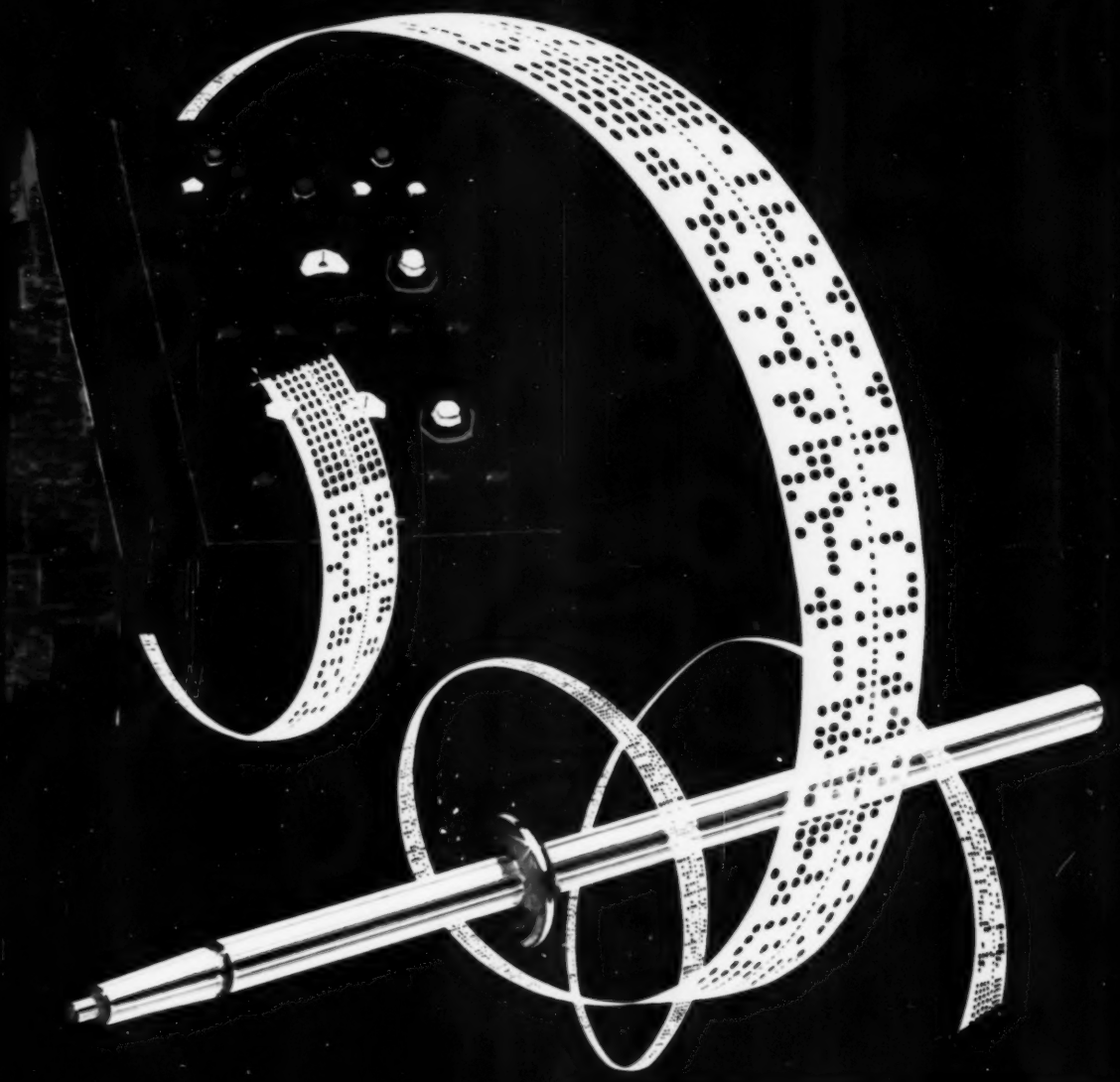
Sincerely,

A. N. Daniels
President

AND/im

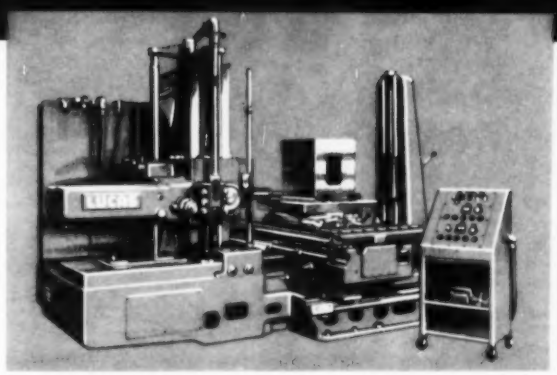
BRYANT CHUCKING GRINDER CO.
16 CLINTON STREET, SPRINGFIELD, VERMONT

BRYANT CENTALIGN

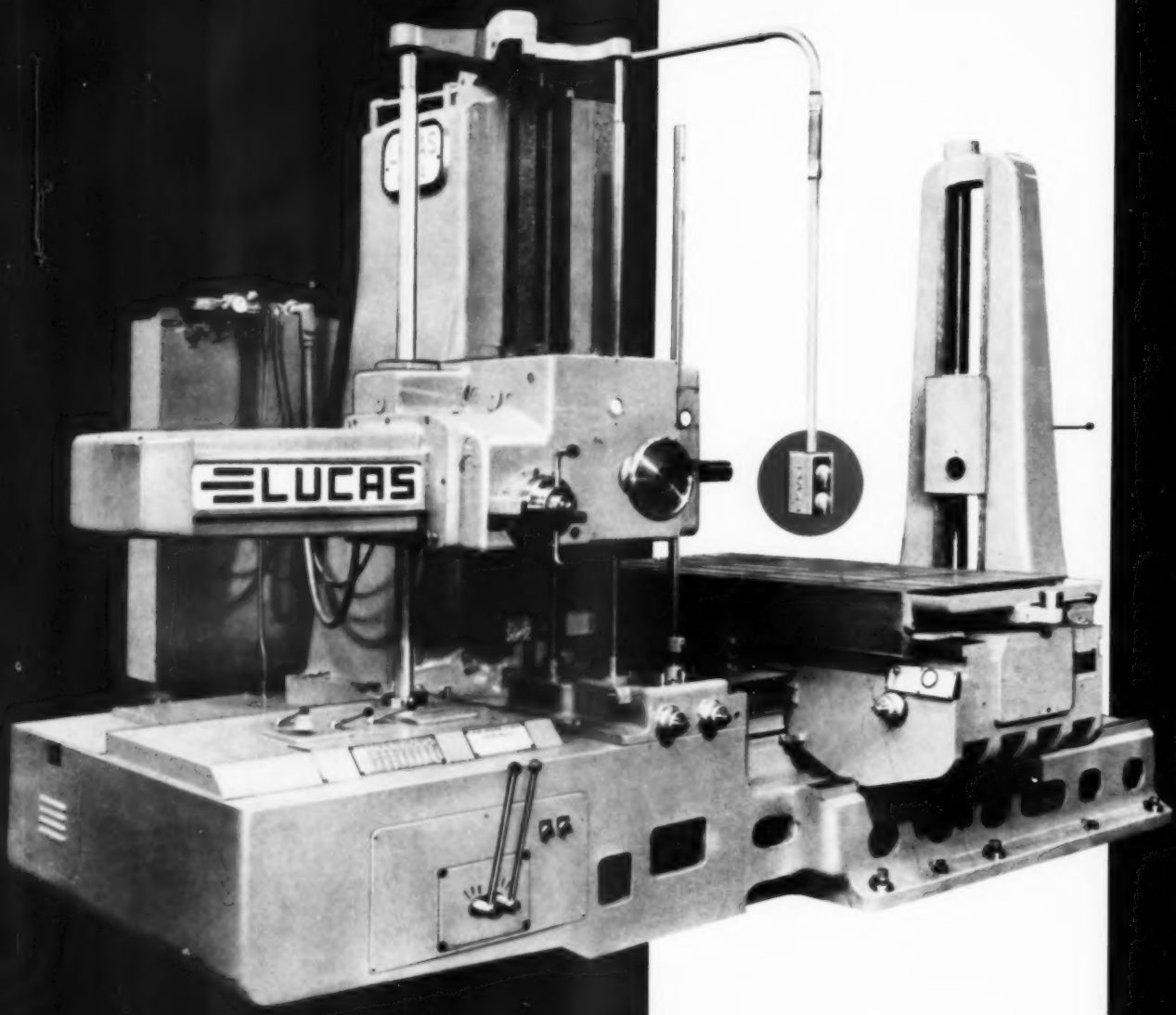


Tape control... certainly!

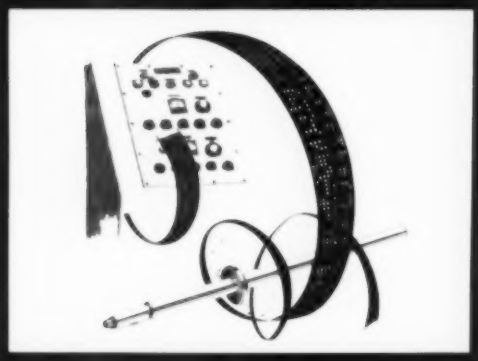
Tape control can readily be applied to any Lucas model, (2 3/4" to 6" diameter spindles) if repetitive operations or complicated one-of-a-kind jobs make this new development advantageous. Lucas tape controlled machines are available with punched tape for N.P.C., magnetic tape for contouring, or tape and tracer control. If you have a profitable use for *any* type or size of horizontal boring, drilling and milling machine (up to 6" spindle capacity) you can get it at its best from the specialist in this type of machine. *Did you ever meet a man who regretted picking a Lucas?*



LUCAS
OF CLEVELAND



Simplified pendant controls . . .

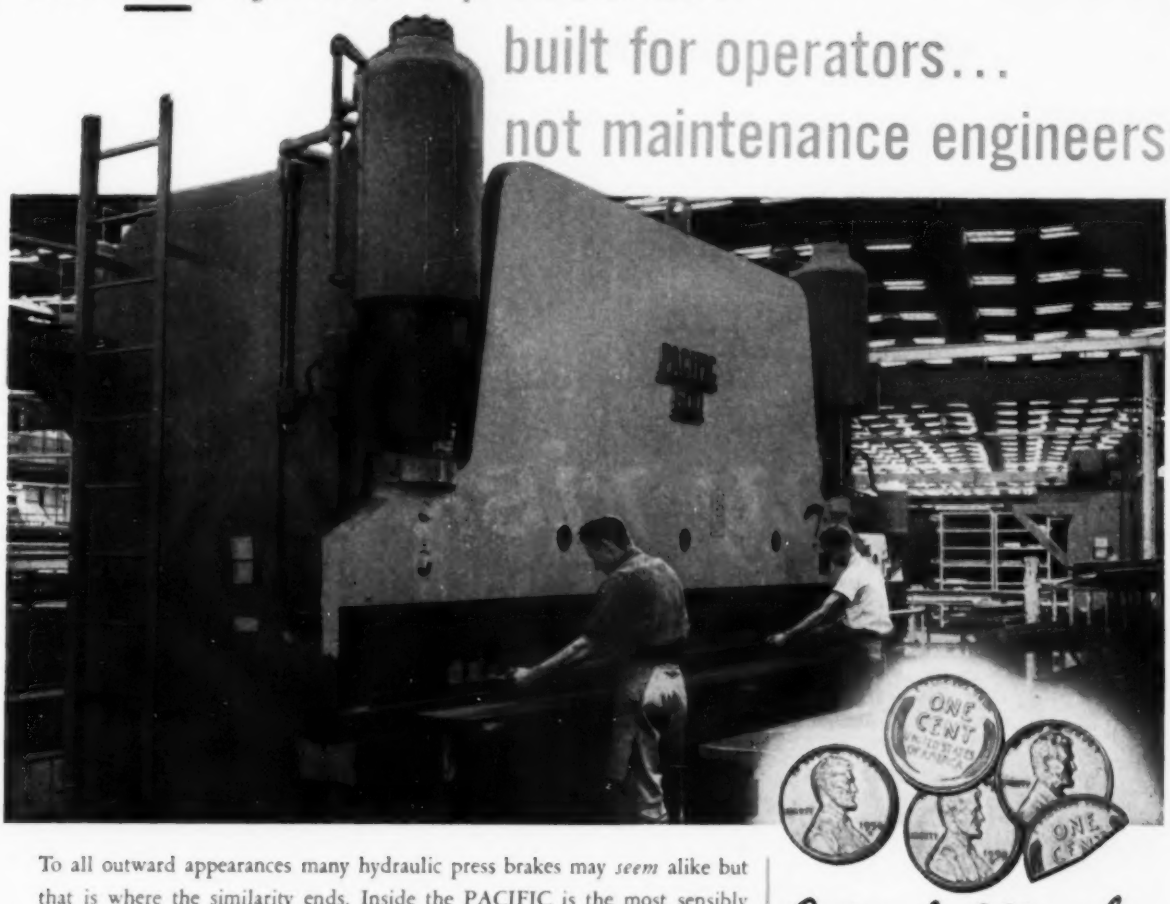


A Lucas performs the greatest variety of operations possible in any machine tool. Standard models permit control of *all* operations from the pendant. Optional pendant and lever control machines, like the one shown above, combine a simplified pendant with readily accessible levers. Whichever type of control you want—pendant, lever, tape, tracer or any of these in combination—Lucas has it.

LUCAS
OF CLEVELAND

The one hydraulic press brake

built for operators... not maintenance engineers



To all outward appearances many hydraulic press brakes may *seem* alike but that is where the similarity ends. Inside the PACIFIC is the most sensibly simple, patented level control system ever devised . . . only 6 microswitches and 2 relays provide the precise PACIFIC accuracy that no other hydraulic press brake can even remotely approach. Free of lineal variable differential transmitters, electronic amplifiers, photo-electric relays, amplidyne generators, complex hydraulic servo-valves, variable volume pumps and other complicated gadgets, PACIFIC hydraulic press brake can be kept in continuous operation by the ordinary plant maintenance man without the costly services of a professional hydraulic or electronic engineer from some distant factory. PACIFIC can be maintained for pennies per operating hour . . . only a fraction of the cost of the complicated machines.

Costs only 4.4¢ per hr. to maintain . . .

EARNS $7.50 NET PER HOUR

Pacific Hydraulic Press Brake at Atlas Universal Service, Inc., San Francisco, has operated continuously 16 hours a day for 9 years and 27 days with average maintenance downtime of only 5.2 hours per year and a total maintenance expense of 4.4¢ per operating hour.

Write for brochure

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

PACIFIC HYDRAULIC BRAKE

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OAKLAND, CALIF. and MT. CARMEL, ILL.

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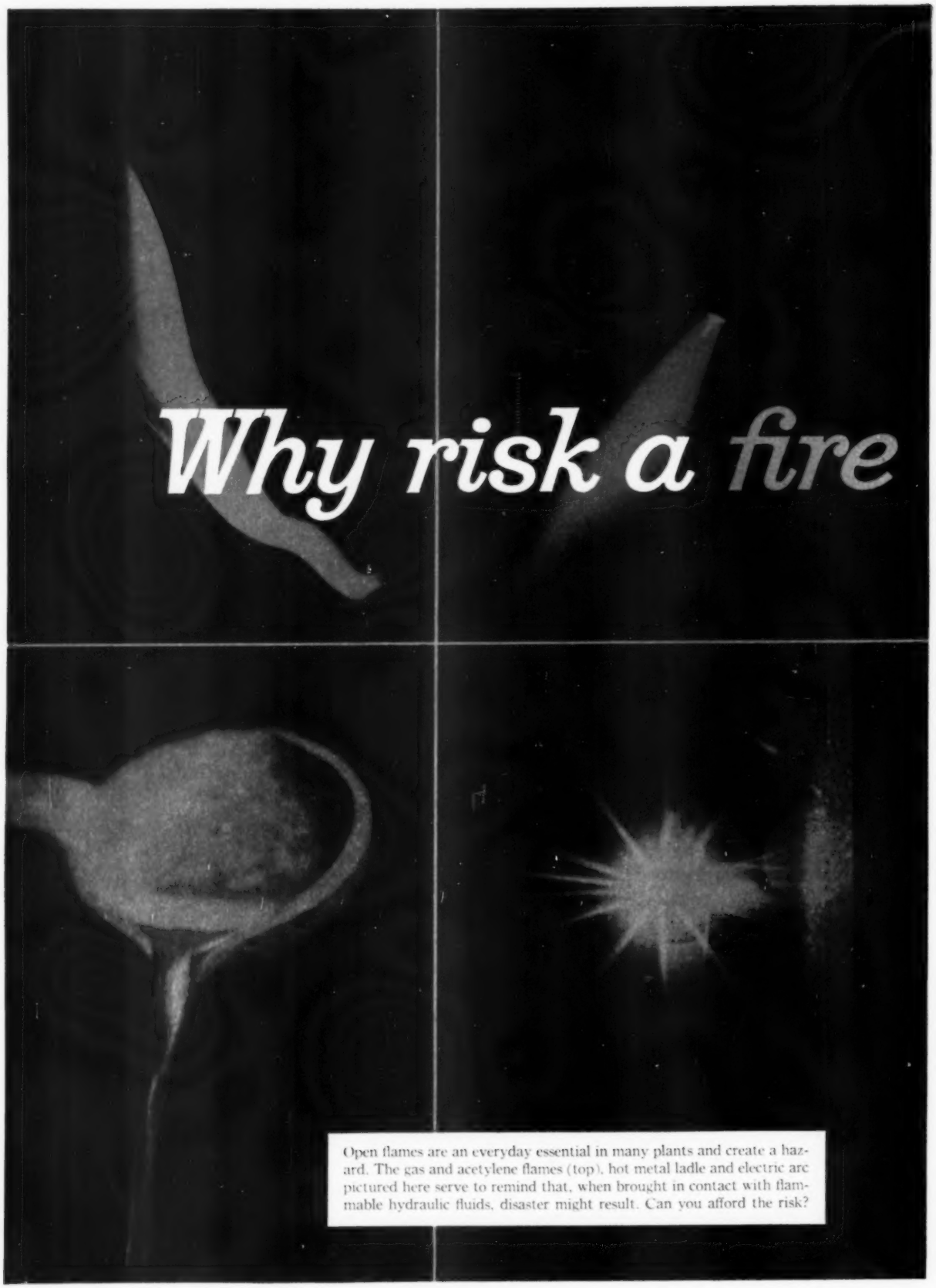


Open flames are an everyday essential in many plants and create a hazard. The gas and acetylene flames (top), hot metal ladle and electric arc pictured here serve to remind that, when brought in contact with flammable hydraulic fluids, disaster might result. Can you afford the risk?

Mobil Research

At left: Test developed by Mobil Research shows how atomized petroleum hydraulic fluid is easily ignited by small gas flame; at right, how when replaced by Mobil Nyvac, no ignition occurs.

disaster? *Insure the safety of your plant and personnel with a Mobil fire-resistant hydraulic fluid!*

Mobil's newly developed family of fire-resistant fluids for hydraulic systems meets every type of industrial requirement . . . provides adequate protection at lowest possible cost.

When you change to Mobil fire-resistant fluids, you get the assistance of trained Mobil engineers who analyze your plant systems, tell you which fluid should be used. Mobil engineers also help you install the fluid properly and set up an effective maintenance program; provide practical field-tested procedures for reducing leakage and increasing efficiency.

These Mobil fluids offer a practical means of safeguarding personnel, property, production schedules . . . increasing your sales profits. Call in your nearest Mobil representative today. He'll be glad to give you full details.

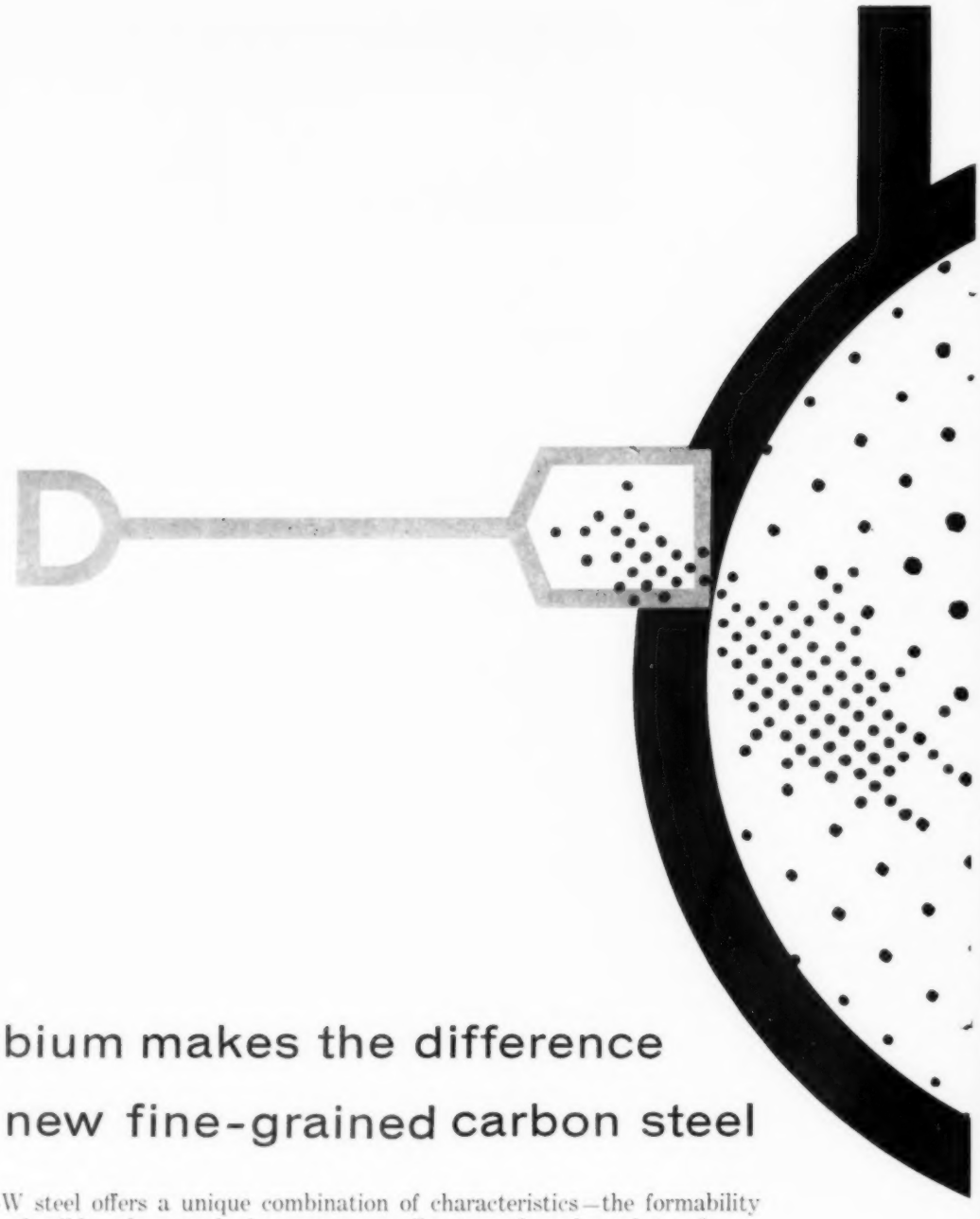
Mobil Pyrogard—a superior synthetic product of the phosphate-ester type family. Very successful in hydraulic systems and multi-stage compressors. Outstanding anti-wear quality; excellent anti-rust and anti-foam properties.

Mobil Nyvac—combines the fire-quenching qualities of water with glycol and special additives for lubricity and viscosity. Rust inhibitors protect machine parts both above and below fluid levels. Unusual resistance to deposit formation and wear. Impressive viscosity stability, anti-corrosion, and anti-foam properties. Excellent performance at low temperatures.

Mobil Solvac—low-cost, oil-water emulsion fluid particularly suited to systems with plunger and centrifugal-type pumps. For systems serving large presses, forging machines, rubber presses and steel mill back-up roll balances. Resists bacterial growth, has excellent rust-inhibiting properties.

PROVED PETROLEUM PRODUCTS
AVAILABLE WITH A
MOBIL PROGRAM OF CORRECT LUBRICATION

Mobil



Columbium makes the difference in this new fine-grained carbon steel

The new GLX-W steel offers a unique combination of characteristics—the formability and weldability of mild carbon steel *plus* greater tensile strength and notch toughness.

The addition of small amounts of columbium gives GLX-W the finer grain structure that makes this possible.

Where design permits, the use of GLX-W can result in weight savings up to 35%, compared with mild carbon steel. With yield strengths ranging from 45,000 to 60,000 psi, GLX-W steels are recommended for a broad range of applications. For technical information, write to our Product Development Division, Department X.

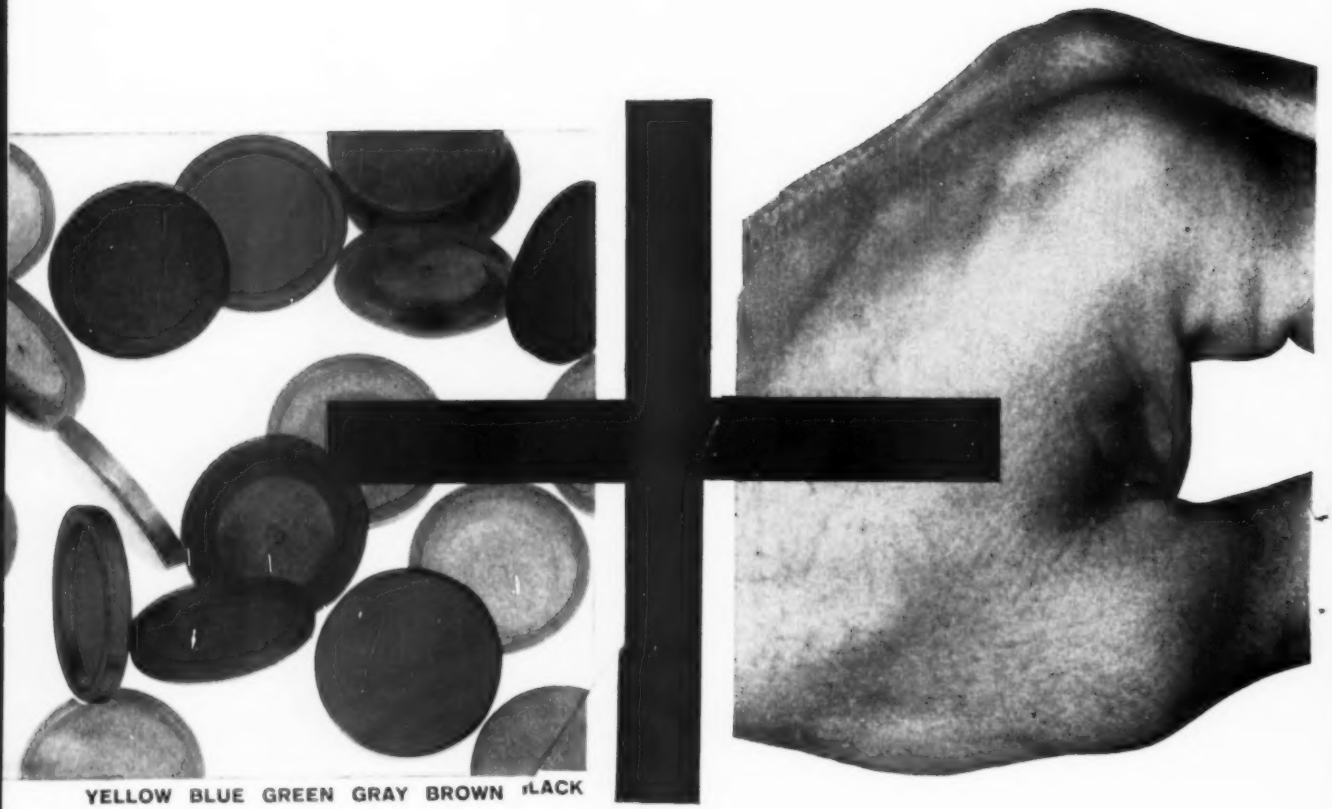
GREAT LAKES STEEL

Detroit 29, Michigan

A DIVISION OF NATIONAL STEEL CORPORATION

GLX-W

CIRCLE 208 READER SERVICE CARD



YELLOW BLUE GREEN GRAY BROWN BLACK

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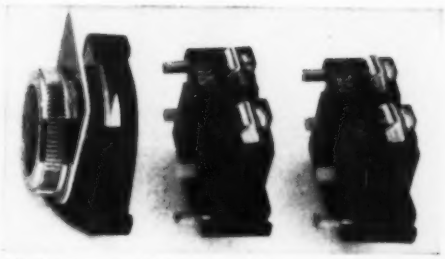
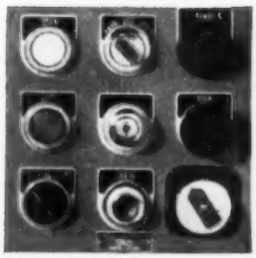
WESTINGHOUSE FLUSH PUSHBUTTON

puts the finger on color coding with snap-on color caps !



Shallow contact blocks stack for multiple control circuits. Angled terminals are easy to get at with a screwdriver, even when blocks are stacked.



Available in a full range of operator designs.

HERE'S PRACTICAL PUSHBUTTON COLOR CODING—the economical Westinghouse way. Snap-on color caps let you change colors *without changing buttons.* Simply remove the clamp ring and color caps snap off easily and can be replaced in a matter of seconds.

Simplified color coding is but one of the many pluses for new Westinghouse flush pushbuttons. Thin operator and shallow contact blocks make this pushbutton *thinnest overall.* Contact blocks stack for control of multiple operations, another space-saving feature.

Flush pushbuttons are oiltite, of course. And they meet exacting machine tool and control panel requirements. Available in a full range of operator designs.

Regardless of your pushbutton requirements, order with confidence from industry's most extensive line. Contact your nearby Westinghouse sales office or distributor, or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

J-30304

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS

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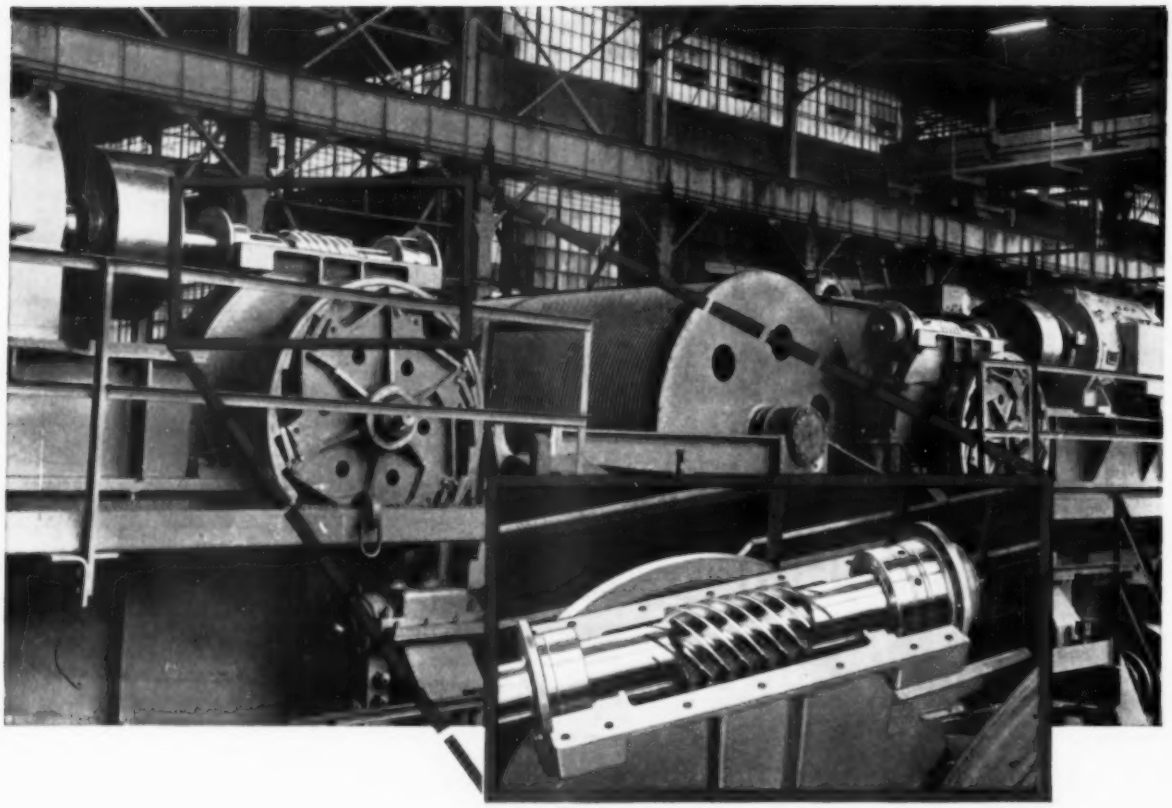

for built-in OEM drives, Cleveland custom components save space, give smoother operation

By using standardized or custom-built Cleveland Worms & Gears, machine designers overcome the frequently troublesome problem of economically providing a quiet and efficient drive in a limited space. Cleveland components are available not only in standard sets but also in special sizes and ratios. Our wide range of special worm gear production equipment places us in an unparalleled position to furnish worms and gears of special designs. We maintain a complete and perpetual master worm and hob inventory that enables ready duplication of *any* Cleveland worm and gear ever made.

Our engineering specialists will gladly give you complete information on any application where specialized worm gear know-how is required. Call them today—they're as near as your phone. Or write for Catalog 201F—it gives complete data on built-in Cleveland Worms and Gears.

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The Cleveland Worm & Gear Company
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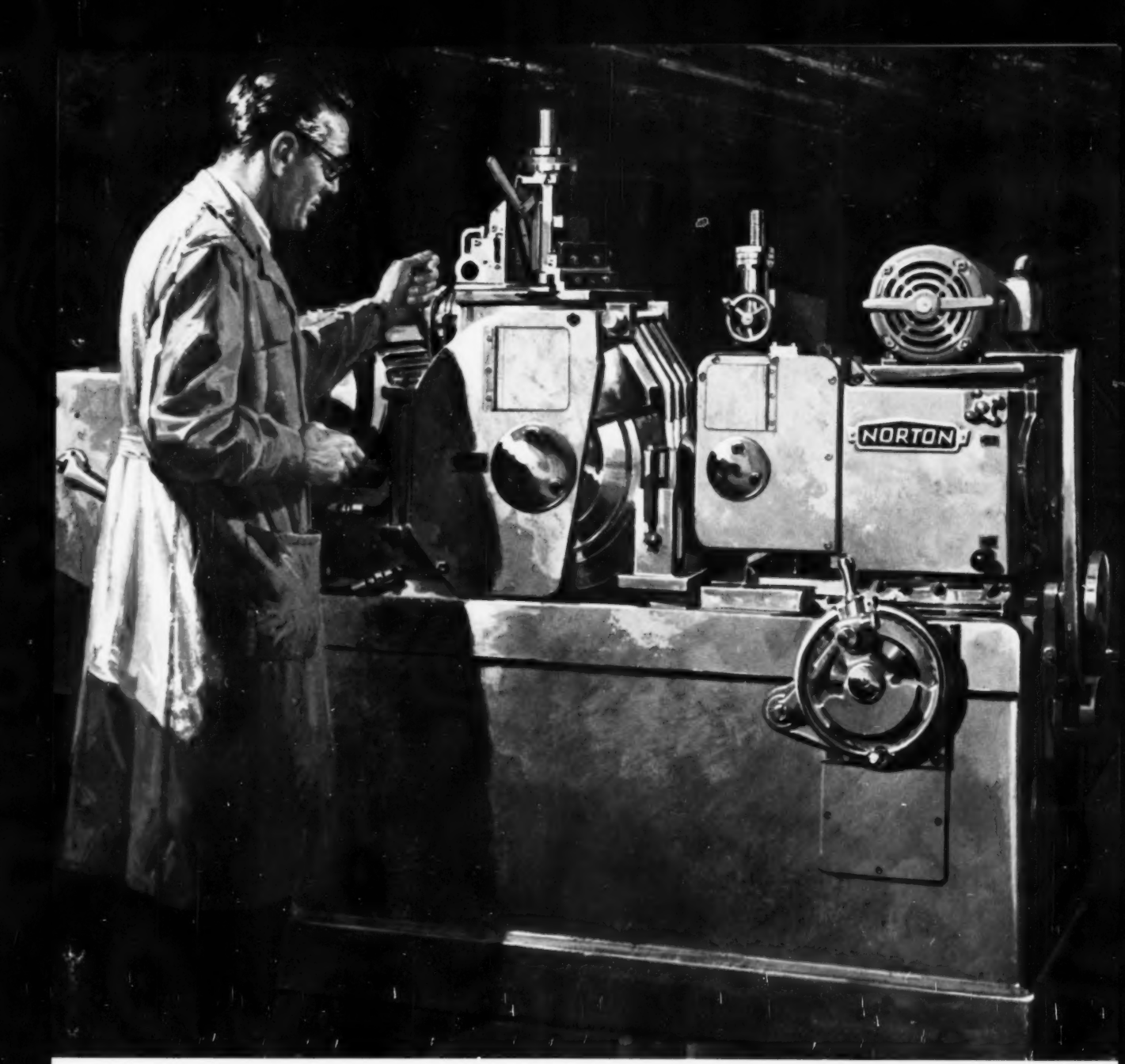
CIRCLE 212 READER SERVICE CARD ►



Now you can add the "Touch of Gold" . . . with the new Norton centerless grinder

The ability to produce better products at lower cost is an *extra* built into every Norton grinding machine.

Now, for the first time, this "Touch of Gold" performance is available in a centerless grinder. The new Norton No. 2 Centerless Grinder, the latest addition to the world's largest line of grinders and lappers, is ready for immediate delivery.

How this sensational new grinder can help you get a new start against competition is worth knowing. Get the whole story from your Norton Man, soon. NORTON COMPANY, Machine Division, Worcester 6, Mass.

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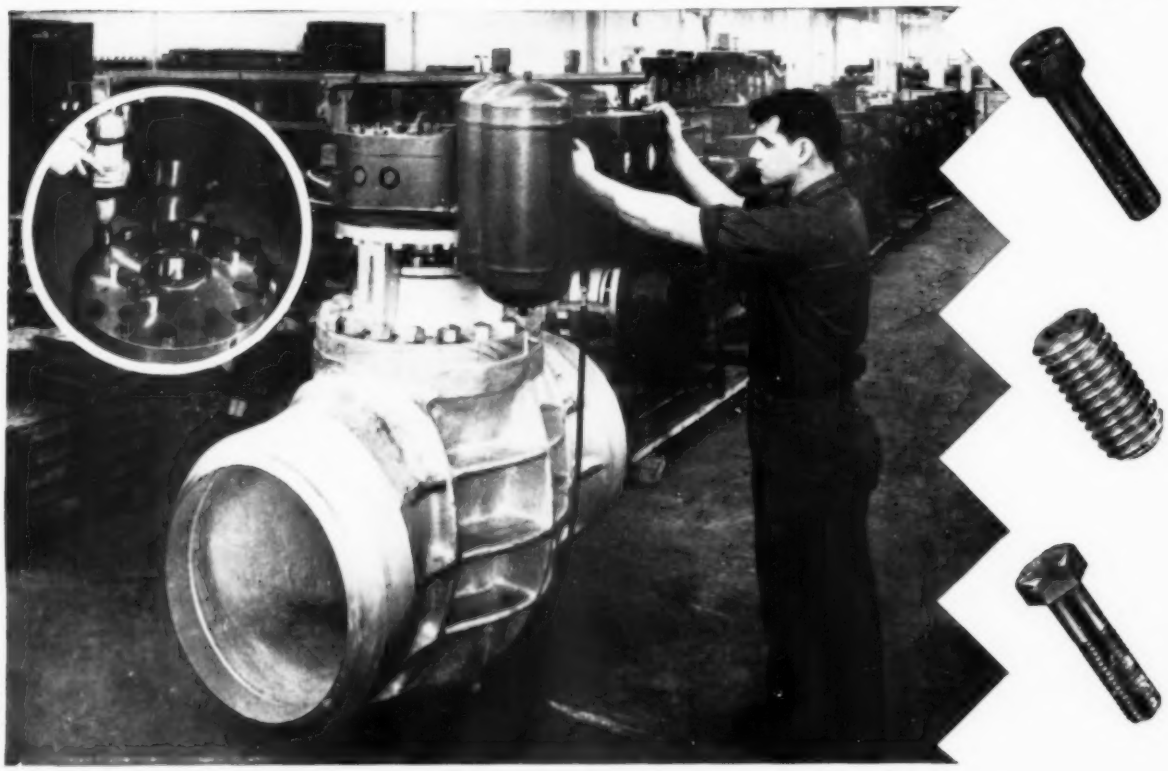
Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

IT PAYS TO STANDARDIZE ON STANSCREW



Stanscrew service adds strength, lowers costs for Shafer Valve Company

The valve operators produced by Shafer Valve Company of Mansfield, Ohio are used to open and close large valves on gas pipe lines . . . often in remote locations, many miles from human supervision. They are subject to sudden surge loads which cause extremely high stresses . . . and their critical importance demands unfailing reliability of all components.

Shafer formerly manufactured their own fasteners for this demanding application from a special high strength steel. Then their distributor arranged for a visit from Stanscrew's fastener specialist. He quickly established that Stanscrew's heat-treated "Carbon Restoration" cap screws, correctly applied, could provide even greater fastener strength . . . and at a significant saving in cost.

The Stanscrew fastener specialist may be able to make similar savings or improvements in your assembly operations. For he brings to your application the experience and facilities which have made Stanscrew a leading supplier of fasteners to the top names in American industry for over 80 years. And he can select money-saving answers to your problems from a complete line of over 5,000 different types and sizes of standard fasteners . . . always in stock, quickly available.

Whatever your fastener requirements, call your nearby Stanscrew distributor today. He will arrange for a prompt visit from the Stanscrew fastener specialist.

STANSCREW FASTENERS

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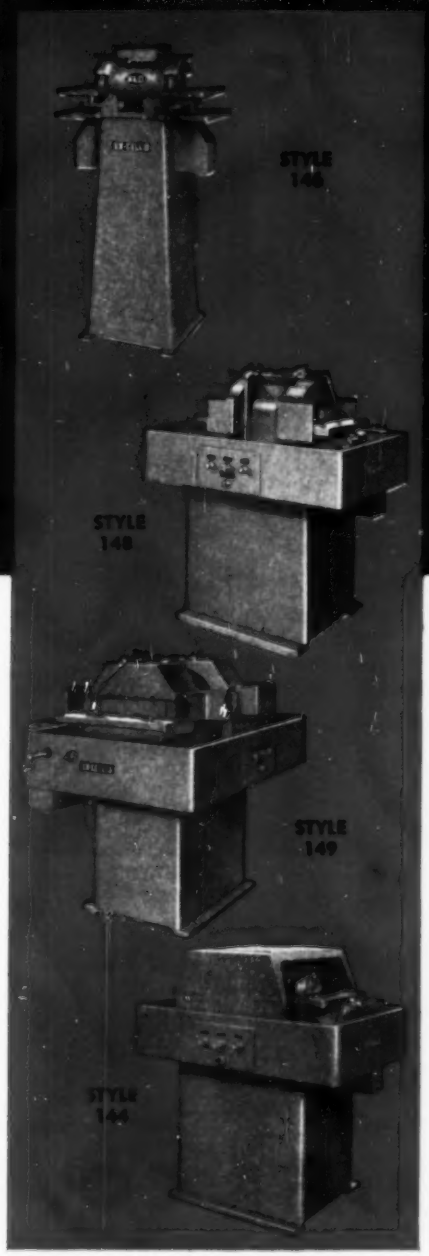
HMS | HARTFORD MACHINE SCREW COMPANY, HARTFORD, CONNECTICUT
WESTERN | THE WESTERN AUTOMATIC MACHINE SCREW COMPANY, ELYRIA, OHIO

STANDARD SCREW COMPANY 2701 Washington Boulevard, Bellwood, Illinois

A FULL LINE OF EX-CELL-O PRECISION TOOL GRINDERS

STYLE 264



Ex-Cell-O Precision Tool Grinder line includes: Style 264 (above), an electrolytic reciprocating model for lower-cost sharpening of carbide tools, and the similar Style 142 (not shown) for conventional grinding; the Style 146 finish grinder, which uses 6" plate-mounted wheels; Style 148, which uses 10" wheels for roughing and finishing larger tools; the Style 149, with 14" grinding wheels and heavy-duty Spindle; and the Style 144 finish grinder with Ex-Cell-O Precision Spindle. Style 264 and 142 provide automatic reciprocation for face grinding, and manual reciprocation for grinding chip breaker grooves.

59-26

For toolroom economy, efficiency and production

Since 1932, Ex-Cell-O Precision Tool Grinders have saved time, increased production and improved toolroom accuracy in sharpening flat and dovetail forming tools; grinding single-point lathe, planer, shaper and boring tools; plunge grinding chip-breaker grooves; and sharpening solid carbide, carbide-tipped, alloy and high-speed steel tools.

For help in selecting the model with the features you need for faster, better tool grinding at lower cost, call your local Ex-Cell-O Representative, or write direct for details on the complete line of Precision Tool Grinders.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

EX-CELL-O FOR PRECISION XLO

Machinery Division

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

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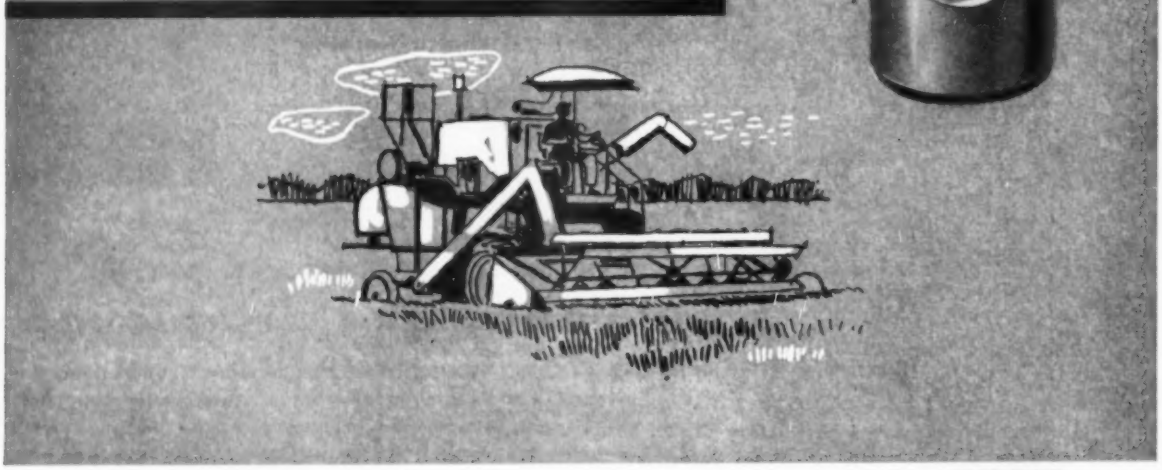
two more cases where PARTS PRODUCED FROM provide excellent bearing properties

CASE HISTORY

MUELLER BRASS CO. 600 ALLOY screw machine product used in heavy duty farm equipment

This heavy duty planetary pinion shaft, made as a screw part from tough "600" series bearing alloy, was the answer to a continuing wear problem encountered in the driving mechanism of heavy-duty farm equipment and big trucks. The part is machine produced to exacting tolerances and all necessary finishing operations are done by Mueller Brass Co. so the pinion shaft is ready for installation when received. Since "600" alloy parts have been installed, no operating failures have been reported and the shafts have proved far superior to the material formerly used.



MUELLER BRASS CO. ANALYSIS SERVICE

You get sound, unbiased advice on the one best method of making your parts because Mueller Brass Co. is the only fabricator in the country offering all these methods of production. An experienced Methods Analysis Department has at its command a complete knowledge of the advantages and limitations of each production process. This unique technical service is your assurance of getting the best product at the best price . . . made the one best way!

COLD-PREST IMPACT EXTRUSIONS

PLASTIC INJECTION MOLDING

MUELLER BRASS CO.

MUELLER BRASS CO. 600 ALLOY

and maximum wear resistance in tough applications

CASE HISTORY

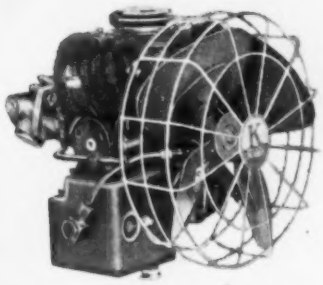
MUELLER BRASS CO. 600 ALLOY forgings used in aviation air compressors

Analyzing the job requirements of Walter Kidde & Company, Inc., for a main driving cam component to be installed in a reciprocating type of aircraft air compressor, Mueller Brass Co. Methods Analysis Engineers decided on a forging fabricated from "600" alloy as the most practical method of production. Since the cam forms the prime component of the driving mechanism, it must have good bearing wear surfaces and because the compressors are used in the aviation industry, the cams must be completely dependable. The close grained, strong forging that resists combination compressive and tensile stresses was the answer.

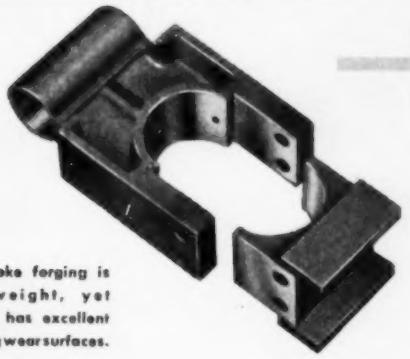
A typical compressor takes in ambient air and compresses it to 3000 psi or higher. This high pressure air is stored in metal or fiberglas containers until needed for actuation of pneumatic system components such as solenoid control valves, brake valves, manual control valves or actuators. These and other pneumatic units retract the entrance door, operate landing gear, wheel brakes, nose wheel steering systems, propeller brakes or perform other functions.

Aircraft in which Kidde compressors are installed include the Boeing 707, the Douglas DC-8, the Lockheed Electra, the Fairchild F-27 and various military aircraft.

Mueller Brass Co. produces press, hammer or cored forgings of any practical shape from a few ounces to 150 lbs. in brass, bronze, aluminum and magnesium in 27 standard, as well as special, alloys.



Aircraft air compressor equipped with hydraulic drive delivers air compressed to 3000 psi at the rate of 6 cfm.



This yoke forging is lightweight, yet strong; has excellent bearing wear surfaces.

Forging is part of the main cam, the prime component of a modified Scotch-type yoke, which is the piston driving mechanism in the air compressor.

POWDERED METAL PARTS

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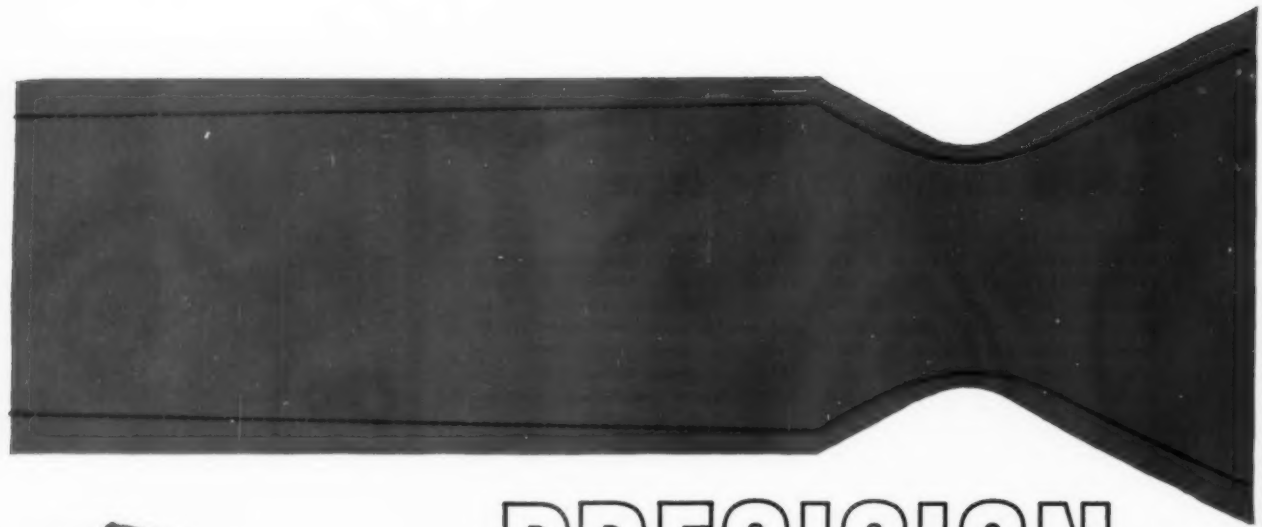
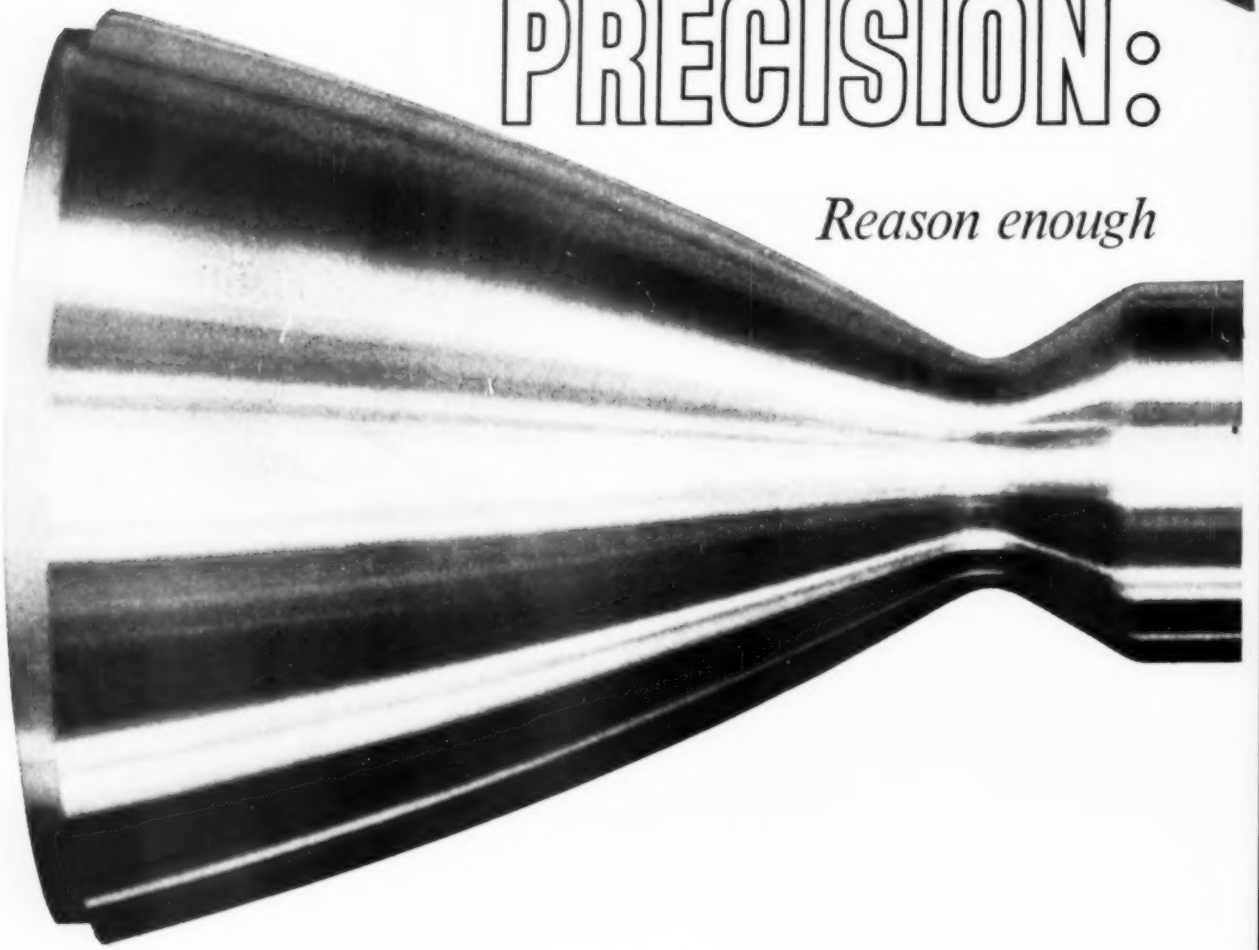
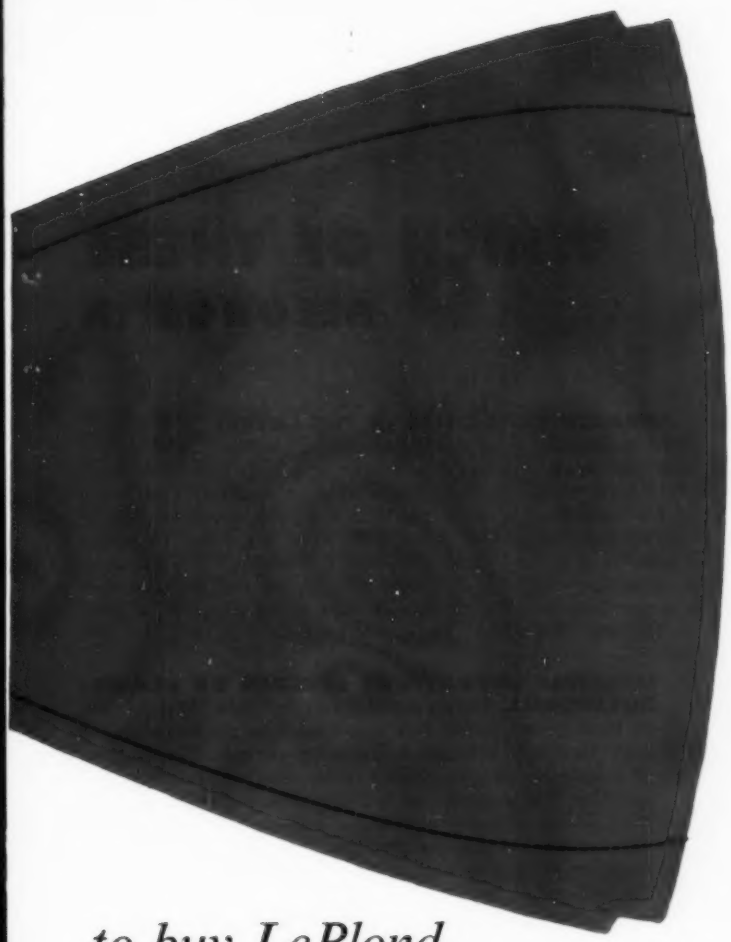


PRECISION:

Reason enough



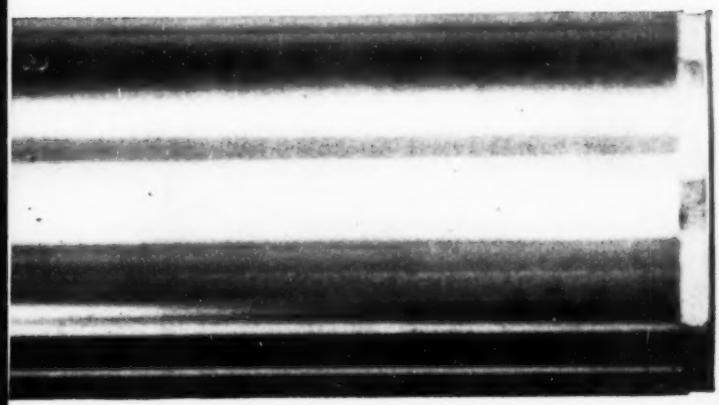


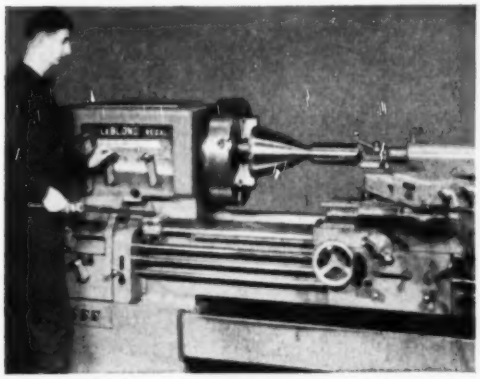
to buy LeBlond

In Hartford, Conn., Delta Corp., specialist in precision fabricating and machining for the aircraft industry, chucks a 350 lb. forging of 347 stainless in its new 24″ LeBlond Regal Lathe. When this missile job comes off the tracer-equipped Regal, it will be a contoured tube weighing only 18 lb. Its walls will vary from $\frac{1}{8}$″ to $\frac{1}{16}$″ according to a rigid and complex pattern. Wall thickness will be held to ±.003″, ID to −.001″ +.000″, OD to ±.008″, and finish will be 20 to 30 rms. If the job is run 3 or 30 times, the same precise result will be achieved.

Dependable precision, like this, is reason enough to buy a LeBlond. And Delta Corp.'s new 24″ Regal backs it up with the versatility of spindle speeds from 18 to 1080 rpm, the capacity of 26″ swing over the bed, the reassurance of 10 hp at 1800 rpm, the repeatability of Hydra-Trace.

People expect precision with extras from the world's largest builder of a complete line of lathes (and of tracers for lathes, too). They have a right to. It's why they buy LeBlonds.





THE R. K. LeBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND of Cincinnati

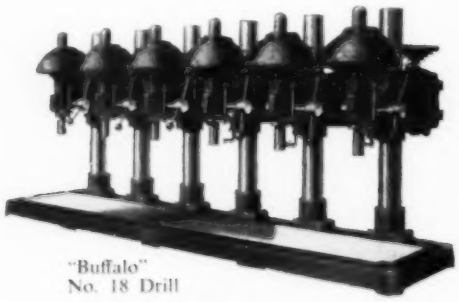
WHICH OF THESE
BELONGS IN

"Buffalo" R-P-Mster

NEW, GREATER CAPACITIES IN THE LATEST "R-P-Msters" — Pioneers in variable speed drilling machines, "Buffalo" "R-P-Mster" drills (left) are newly redesigned to bring you greater capacities. And, prices have been revised to bring you a pleasant surprise! This is the machine for high-speed, accurate production drilling, providing infinite spindle speed changes between 75 and 1300 RPM in the No. 3A Model with 2" capacity. The new, higher capacity "R-P-Msters" have the same streamlined design, rugged and massive construction and the smoothest operation ever built into a drilling machine. Get the complete facts on the new "Buffalo" "R-P-Mster" Drills. Use convenient coupon.

MULTIPLE OPERATIONS SPEEDED BY HEAVY-DUTY DRILL. Powerful and rigidly-built, the "Buffalo" No. 18 Drill is designed to help operators turn out better, faster work. Operation is simple; adjustments are easy. Choose from 19 models to suit your drilling needs exactly — single spindle bench or floor models and multiple units up to six spindles. Minimum deflection is the result of 6-spline alloy steel spindles which turn smoothly on precision ball bearings. Select the models best fitted to your needs — use handy coupon.

A "STAND-OUT BUY" FOR GENERAL SHOP WORK. The "Buffalo" No. 16 Drill offers you more quality features than any machine in its price range: 4 rates of power feed — 5-speed V-belt drive — hardened tool steel clutch members. These features are bound to lower your production costs — through faster and easier drilling, longest useful tool life and peak accuracy. Available in bench, floor or pedestal types, and in multiple units up to six spindles. For complete information on the "Buffalo" No. 16, mail coupon.



"Buffalo"
No. 18 Drill

ESTABLISHED 1877
"Buffalo"
MEMBER N.M.T.B.A.

BUFFALO FORGE
509 Broadway

Canadian Blower & Forge Co., Ltd.

DRILLING PUNCHING

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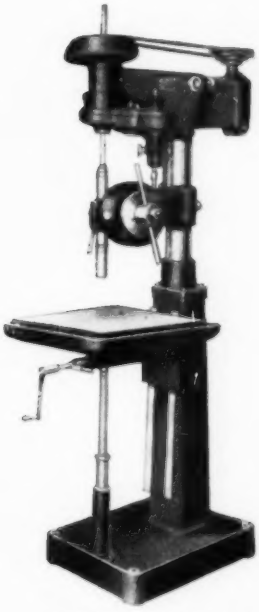
"BUFFALO" DRILLS YOUR PLANT?

NEW FEATURES MAKE A FINE DRILL BETTER. Reports from users of the new "Buffalo" No. 15 Drill are beginning to come in to us. Owners, shop foremen, operators are all enthusiastic. They like the many design improvements which result in easier, faster operation, flexibility and a minimum of maintenance. Although unusually sensitive, the No. 15 is ruggedly built for full capacity operation without wear or strain. The new line includes bench, floor and pedestal models from 1 to 6 spindles. For complete data on the "Buffalo" No. 15 Drill, check and mail handy coupon.

"Buffalo" No. 22 Drill



"Buffalo" No. 16 Drill

"Buffalo" No. 15 Drill

HIGH PRODUCTION, COMPLEX DRILLING OPERATIONS PERFORMED FASTER—With batteries of multiple-spindle "Buffalo" No. 22 Drills (above). The operator of each bank can handle 2 to 4 setups with no stopping for adjustments. These husky, 96-inch high machines operate as easily as smaller sensitive drills, yet have a capacity up to 1¼" in mild steel. No wonder operators are enthusiastic — each spindle has both power and sensitive feed; all controls are within easy reach. "Buffalo" No. 22 Drilling Machines can add more profitability to *your* shop operations. Check and send coupon to find out *how!*

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portrait of an emotional scar

How can you depict the shock, anger and disappointmen' that really takes place when it happens? How does *anybody* know how it feels to see a die crack during the last few minutes of heat treating? How can anybody know, except the man responsible for purchasing the original piece of steel?

What went wrong? Heat treating procedures checked out O.K. And it *should have* been a good piece of steel. It came from a reliable mill that uses all the standard methods of specialty steelmaking and applies all the normal quality controls. Furthermore, tool and die steel from the same mill had been satisfactory on other jobs.

Predictable performance . . . no predicaments. *Carpenter's revolutionary new* MEL-TROL® *process* is not a standard method for making specialty steels. It's exclusive. It utilizes a new patented mold which reduces segregation of harmful impurities during solidification of the ingot. This ingot is far more uniform. You get steel which is cleaner, sounder, tougher from surface to center . . . in every bar . . . in every lot. It takes the guesswork out of toolmaking, because you know *in advance* what results you will get.

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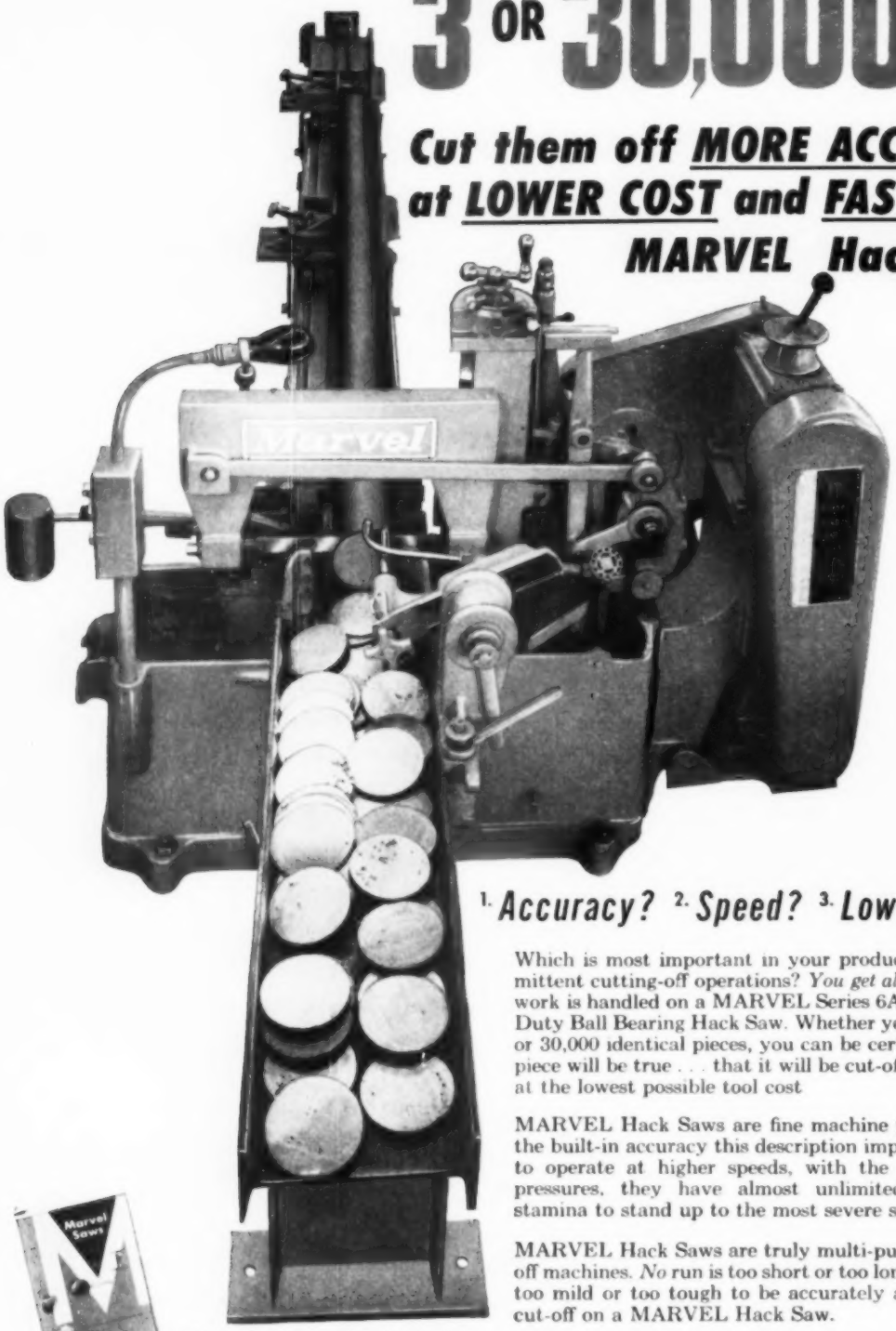
CIRCLE 222 READER SERVICE CARD

3 OR 30,000 PIECES

Cut them off MORE ACCURATELY at LOWER COST and FASTER on a MARVEL Hack Saw



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Which is most important in your production or intermittent cutting-off operations? *You get all 3* when your work is handled on a MARVEL Series 6A or 9A Heavy Duty Ball Bearing Hack Saw. Whether you're cutting 3 or 30,000 identical pieces, you can be certain that each piece will be true . . . that it will be cut-off quickly, and at the lowest possible tool cost.

MARVEL Hack Saws are fine machine tools, with all the built-in accuracy this description implies. Designed to operate at higher speeds, with the heaviest feed pressures, they have almost unlimited power and stamina to stand up to the most severe service.

MARVEL Hack Saws are truly multi-purpose cutting-off machines. *No* run is too short or too long, *no* material too mild or too tough to be accurately and efficiently cut-off on a MARVEL Hack Saw.

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Cost Estimators and Standards Engineers to estimate manufacturing and engineering costs, develop estimating standards and write operation sequence sheets for the manufacture of components and subassemblies of complex data processing equipment.

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SUNDSTRAND *"Engineered Production"* NEWS

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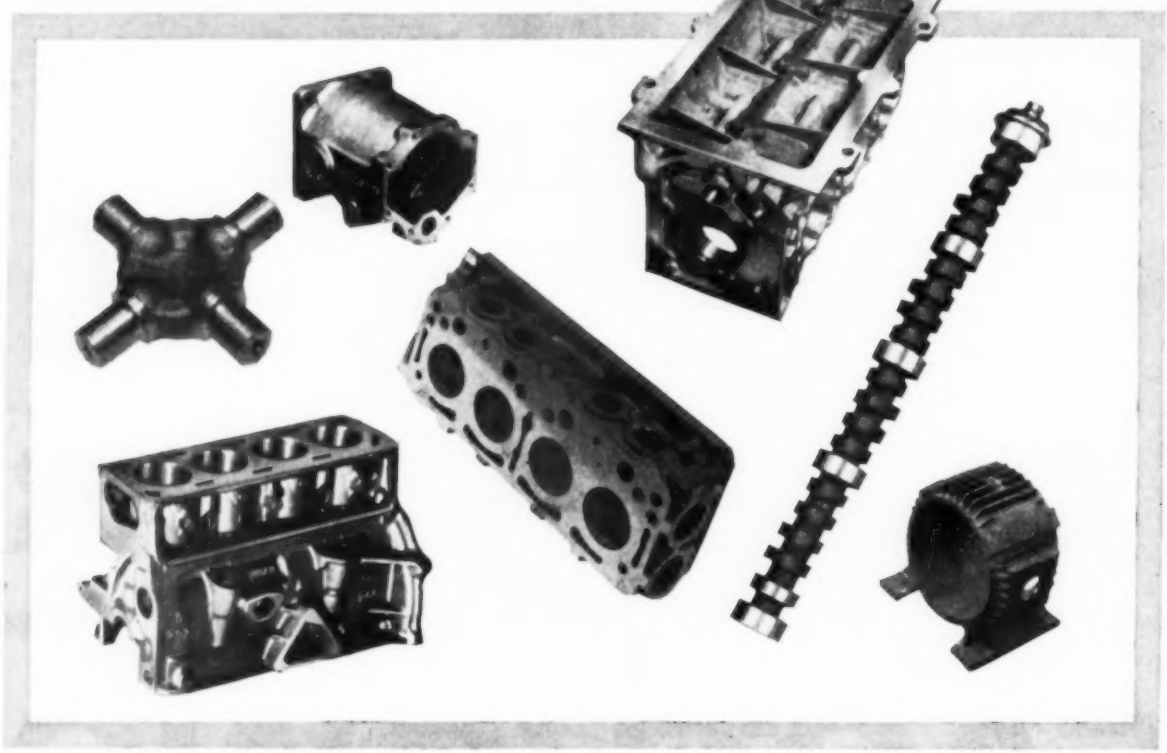
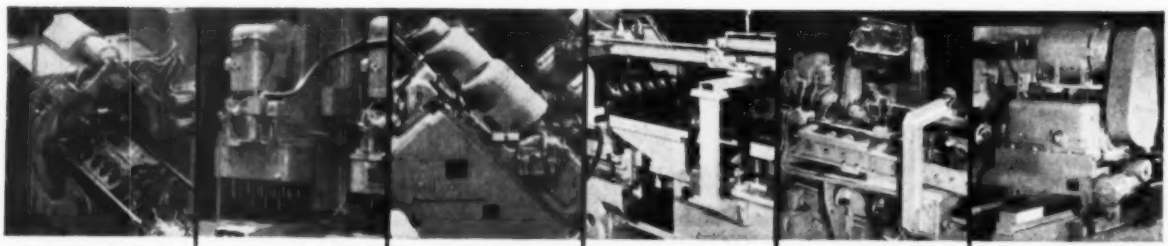


Get your best machine buy after a Sundstrand *"Engineered Production Analysis"*

Whether the job calls for milling, turning, boring, drilling, or any combination of these and any other operations, a Sundstrand "Engineered Production" analysis assures the most efficient processing method. Standard components like those shown below reduce original investment.



"Engineered Production" Service

SUNDSTRAND

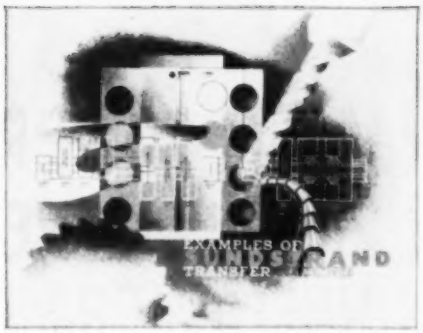
Sundstrand solutions include many years of experience with all three basic types of process machines: (1) *Work transfer* where work progresses from one station to the next and is located in another fixture, (2) *pallet type* where work and fixture move together, and (3) *indexing or dial type* consisting of an indexing rotary table and enough machining stations for the required operations.

Factors considered as part of a Sundstrand "Engineered Production" analysis that determine the best type of machine for the job include: Hourly and total production required, shape of the part, material composition, required locating points, and numerous related factors.

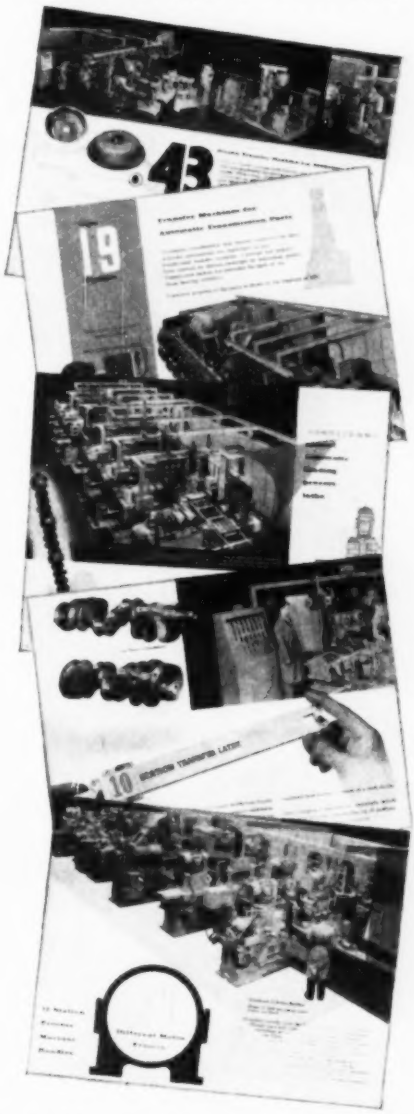
Broad use of standard components in designing special machines provides two outstanding benefits: (1) Lower initial capital equipment outlays and (2) simpler, lower cost modification when change occurs in parts being processed.

Processing lines built by Sundstrand offer from less than 10 to more than 40 separate work stations with multiple operations being performed at many stations. Brief descriptions of these typical solutions are contained in a booklet available from Sundstrand. Parts being processed include cylinder blocks, crankshafts, camshafts, electric motor frames, transmission housings, and brake drums.

For more details on how Sundstrand applies "Engineered Production" solutions to insure the best machining method write for Bulletin 109.



HERE ARE TYPICAL SUNDSTRAND SOLUTIONS



SUNDSTRAND MACHINE TOOL

DIVISION OF SUNDSTRAND CORPORATION

BELVIDERE, ILLINOIS

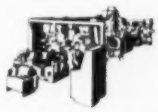
SUNDSTRAND

More facts about
SUNDSTRAND
"Engineered Production"

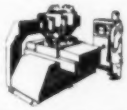
Literature listed under various machine types has more details. Write Sundstrand for your copy today.

Automatic and Tracer Lathes
Bulletin A-109

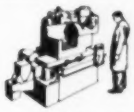
Engineered Milling Production
Bulletin B-109



Examples of Transfer Machines—Bulletin C-109



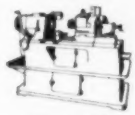
Multiple-spindle Drilling Machines—Bulletin D-109



Internal and Rotary Surface Grinders—Bulletin E-109

Broaching Tools
Bulletin F-109

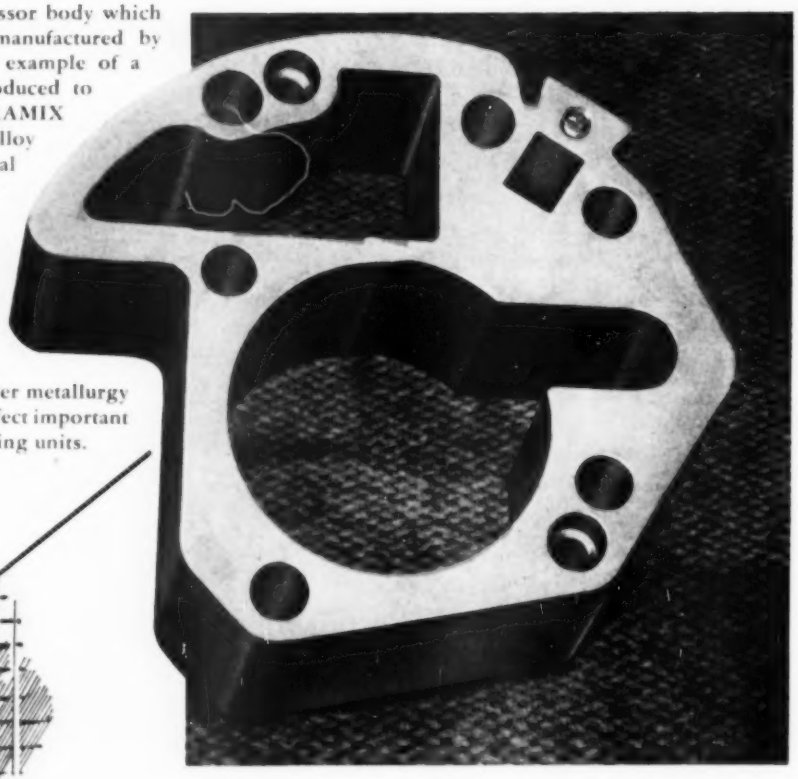
Practical Broaching Methods
Bulletin F-109



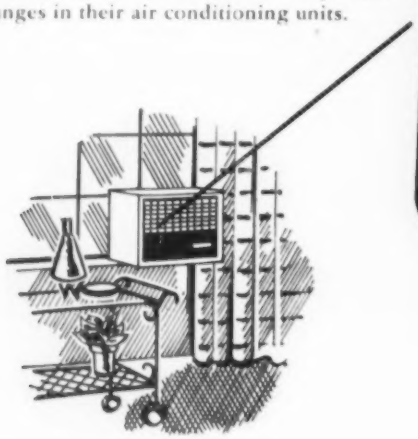
Thread Milling
Bulletin G-109

GRAMIX® COMPRESSOR BODY IS VITAL PART IN GENERAL ELECTRIC AIR CONDITIONER . . . this GRAMIX part is a new concept in powder metallurgy techniques . . . engineered to meet requirements of GENERAL ELECTRIC's new compressor design

This large, complex shaped compressor body which is employed in air conditioners manufactured by General Electric is an outstanding example of a GRAMIX part engineered and produced to exacting specifications. As in all GRAMIX products of powder metallurgy, the alloy was created to meet exacting physical properties required in this particular application. Correct briquetting, controlled sintering procedures, precise finishing operations and rigid quality control throughout the manufacturing process assures General Electric uniform, dependable GRAMIX parts. The production of this body as a product of powder metallurgy has also enabled General Electric to effect important design changes in their air conditioning units.



This part is shown full size. Actual weight: 2¼ lbs.



PM PM MEMBER

Write today for these helpful engineering manuals. Engineering Bulletin No. 18 covers design and metallurgical requirements and alloy selection of GRAMIX bearings. No. 19 contains facts about GRAMIX Machine Parts and No. 21 contains general information on GRAMIX products from Powder Metallurgy. Get your copies now.

X-274-1

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proven design features . . .

Here is the first in the all new, field tested line of heavy duty Nebel Lathes.

It is a versatile extension bed gap lathe, providing 26½" swing over the upper bed, 46" swing through the gap and 48" to 84" distance between centers in the base length.

It is built to complete A.S.A. standards and tolerances of accuracy for engine lathes, still maintaining Nebel economy.

- Heavy duty 3-bearing spindle with zero precision bearings.
- 18 spindle speeds through complete gear range . . . up to 1500 RPM . . . streamlined speed selection.
- 60 different feeds . . . 60 thread changes, all directly read.
- Automatic lubrication.
- Wide design carriage with 146 square inches of bearing surface on bed ways.
- Double-wall one piece totally enclosed apron with simplified controls.
- End gearing totally enclosed in self-lubricating housing.
- Power traverse heavy duty tailstock with rugged thrust lock.
- Rigid box girth design of upper and lower bed . . . hardened and ground steel bedways on upper bed.
- Maximum diameter in gap faced in one setting of tool.

Write for new, fully descriptive Bulletin No. 211.

Nebel Lathe Division • Nebel Machine Tool Corp.
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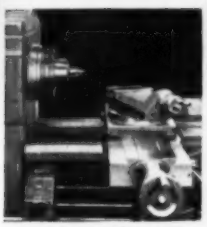
NEW



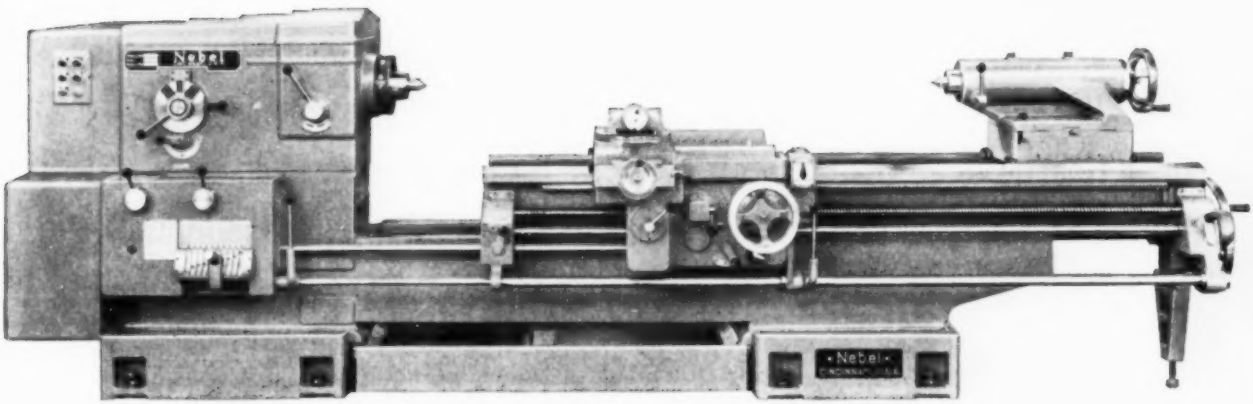
a rugged engine lathe

a versatile gap lathe

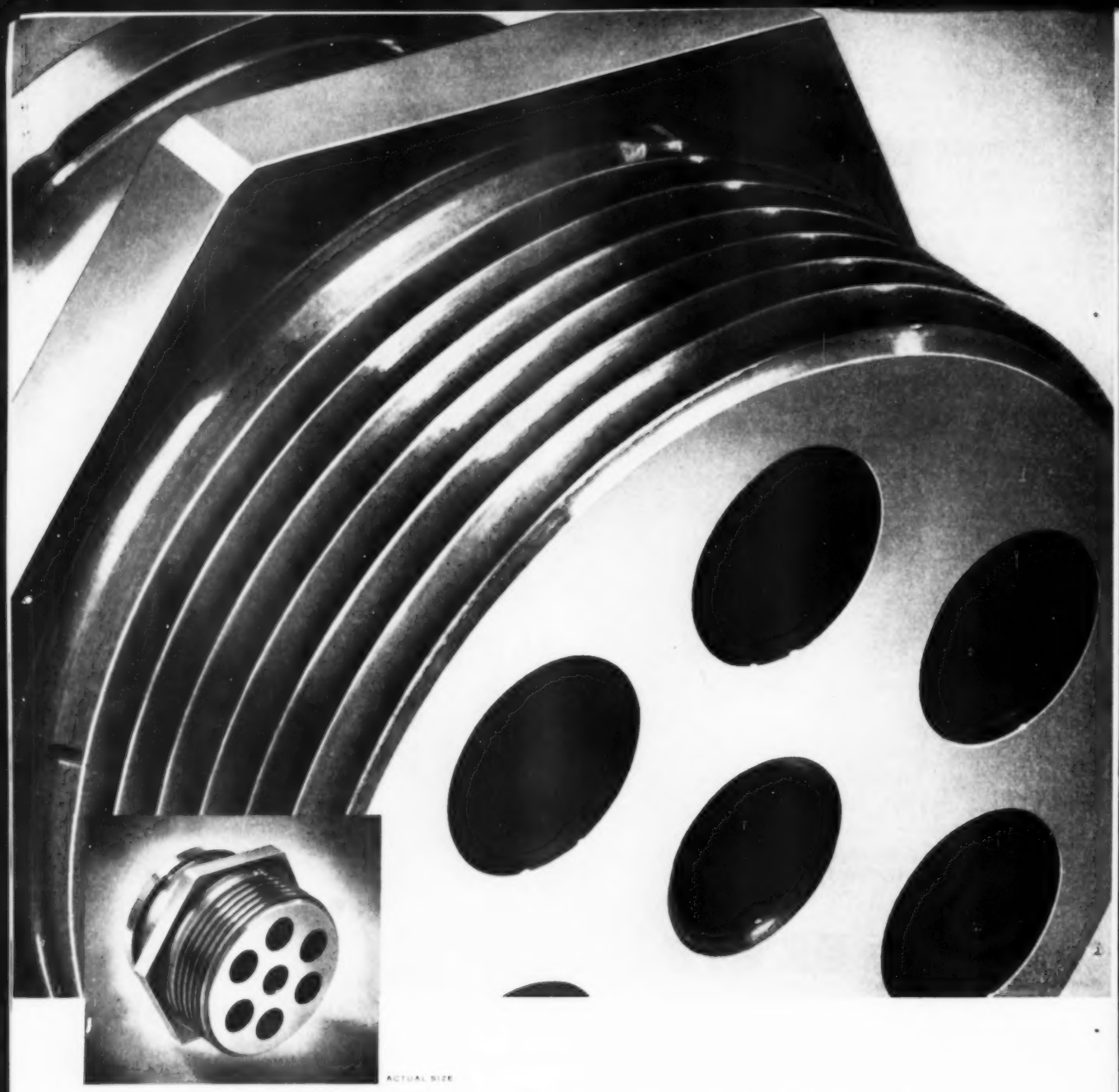
NēBEL

HEAVY DUTY DOUBLE PURPOSE LATHE

entirely new, proven design



NEBEL MODEL HXB 26/45 HEAVY DUTY EXTENSION BED GAP LATHE



ACTUAL SIZE

Notice the fine finish and the smooth, clean threads on this transformer electrode part. You also get longer tool life and higher machining speeds with USS Free-Machining Leaded Steel. Available in Bessemer and Open Hearth, in all the usual sizes. Write for more information to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

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"THE OUTSTANDING TOOL ROOM LATHE" FOR

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HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N. Y.

CIRCLE 230 READER SERVICE CARD

CIRCLE 231 READER SERVICE CARD ►

R. Hoe reports high machining speeds, consistently smooth

GULF MAKES THINGS

As the world's largest manufacturer of printing press equipment, R. Hoe & Co., Inc., New York, N. Y., does an enormous volume of precision machining. The company operates some 2,100 machine tools at plants in New York City and in Dunellen, New Jersey.

John Penberthy, Plant Maintenance Superintendent, reports that selection of the proper cutting oils for their thousands of machining operations is no small problem. But he quickly explains how they've solved it.

"We consider ourselves experts at printing press design and construction, rather than cutting oil specialists," says Mr. Penberthy. "That's why we have used Gulf engineering service and Gulfcut oils for more than 15 years to help us with our machining problems —especially those involving high speed, high temperature cutting.

"For example, in the high-speed milling of shafts, gears, pinions and other close-tolerance parts for our presses, Gulfcut 41C allows us to machine the pieces faster, without sharply reducing tool life. At the same time it helps us get a smooth finish that eliminates the need for many follow-up grinding operations."

Erection shop at R. Hoe & Co., Inc., where their printing presses are pre-assembled for testing before shipment. One of the new high-speed Hoe presses can print 70,000 newspaper pages per hour—in color.

Under the nameplate that identifies the oldest and biggest name in printing press manufacture are John Penberthy, left, Plant Maintenance Superintendent, and C. J. Ramsey, Gulf Sales Engineer. For their huge volume of precision machining, Hoe has relied on Gulfcut oils and Gulf service for over 15 years.

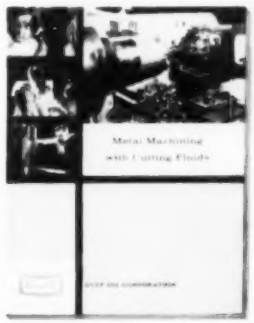
finishes, using Gulfcut . . .

RUN BETTER!

That's just one of many ways in which Gulf makes things run better for R. Hoe & Co., Inc. Perhaps a Gulf Sales Engineer can help improve *your* machining practices, too. Just call the nearest Gulf office.

GULF OIL CORPORATION
Department DM, Gulf Building
Pittsburgh 30, Pa.

NEW 100-PAGE MANUAL tells all about cutting oil selection and usage. Send for your free copy of "Metal Machining with Cutting Fluids."



SP 9634

IT'S LIGHTER THAN YOU THINK!

WHEN DIE CAST with ZAMAK

These tiny zinc die cast electrical contact socket cups have a minimum wall thickness of .005"— **the thinnest wall section ever die cast.** Designed by Omaton Division of BURNDY CORPORATION, they more than meet Government specifications and are adaptable for many types of solderless multi-contact connectors.

It takes 10,371 of the smallest cups to weigh a pound and they are 20% lighter than the ones formerly made from drawn steel. Each is precision die cast to a remarkable degree of uniformity and accuracy, despite the complex design.

Such extremely thin-wall sections—possible only with zinc die castings—**frequently eliminate competition from all other materials and production methods.** In addition, ZAMAK zinc die castings provide many more advantages—and all at lower cost.

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

160 Front Street · New York 38, N. Y.

HORSE HEAD PRODUCTS

◄ CIRCLE 232 READER SERVICE CARD

CIRCLE 233 READER SERVICE CARD

PERFORMANCE REPORT

R. J. Huff, Granite City maintenance superintendent, points out Morgoil bearings to J. H. Koester, Granite City lubrication engineer, and W. P. "Sandy" Wehking of Standard Oil.

How *STANOIL Industrial Oil has been delivering on 22-year assignment at Granite City Steel*

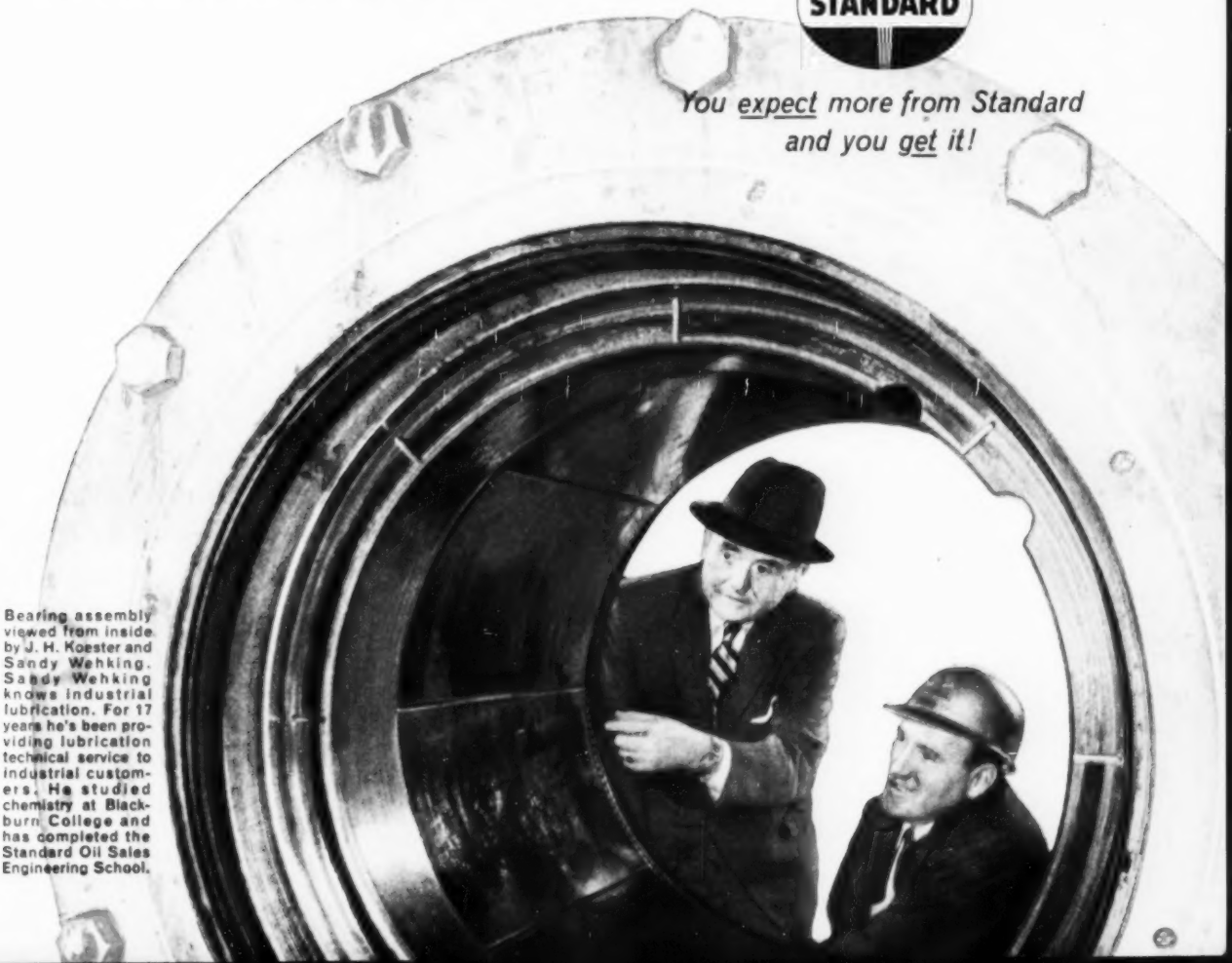
Situation: In 1937, Granite City Steel installed STANOIL Industrial Oil in the Morgoil Back-up Roll Bearings in the five-stand finishing train of their hot strip mill. Each bearing has a load-carrying capacity of more than three million pounds. The oil on which these bearings ride must be of high quality to meet the requirements of this severe service. A narrow viscosity range is required to assure proper operation of the mill throughout the speed range. More than 10,000 gallons of water per minute cool the work rolls. The oil thus must have superior demulsibility to prevent water contamination.

What has happened: Today approximately 1,800 tons rolled is the average shift production. A record of over 2,700 tons rolled has been racked up by one shift in this mill. STANOIL Industrial Oil has continued to deliver top operating performance under these increasingly demanding conditions. Samples of the oil are taken regularly by the Standard Oil lubrication specialist for laboratory analysis to make sure the oil is maintaining specifications. Stocks of STANOIL Industrial Oil are warehoused by Standard at East St. Louis, only twelve miles away, so that the mill has a ready source for the product whenever needed.

What you can do: Get all the facts about STANOIL Industrial Oil from the Standard Oil lubrication specialist near you in any of the 15 Midwest or Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Ill.**

STANDARD

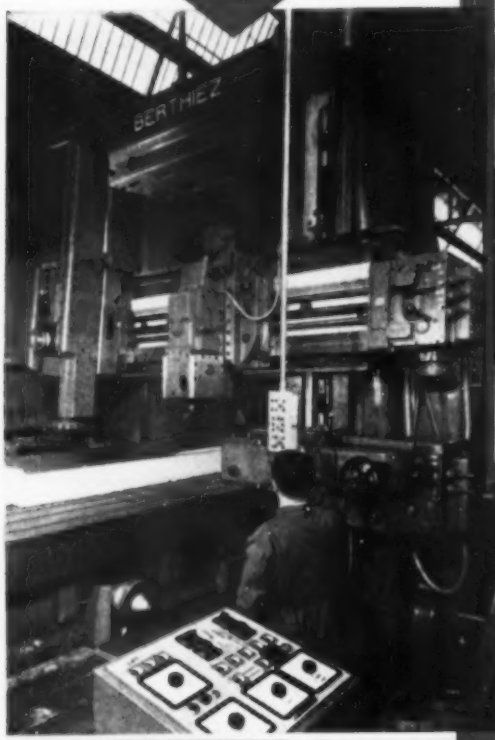
You expect more from Standard and you get it!

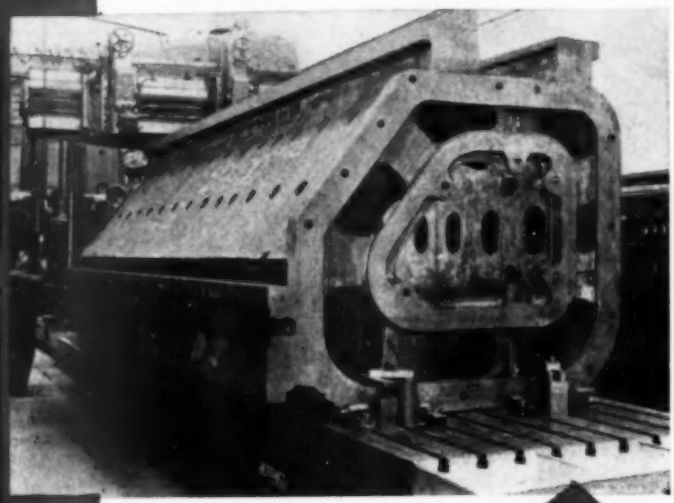


Bearing assembly viewed from inside by J. H. Koester and Sandy Wehking. Sandy Wehking knows industrial lubrication. For 17 years he's been providing lubrication technical service to industrial customers. He studied chemistry at Blackburn College and has completed the Standard Oil Sales Engineering School.

BERTHIEZ

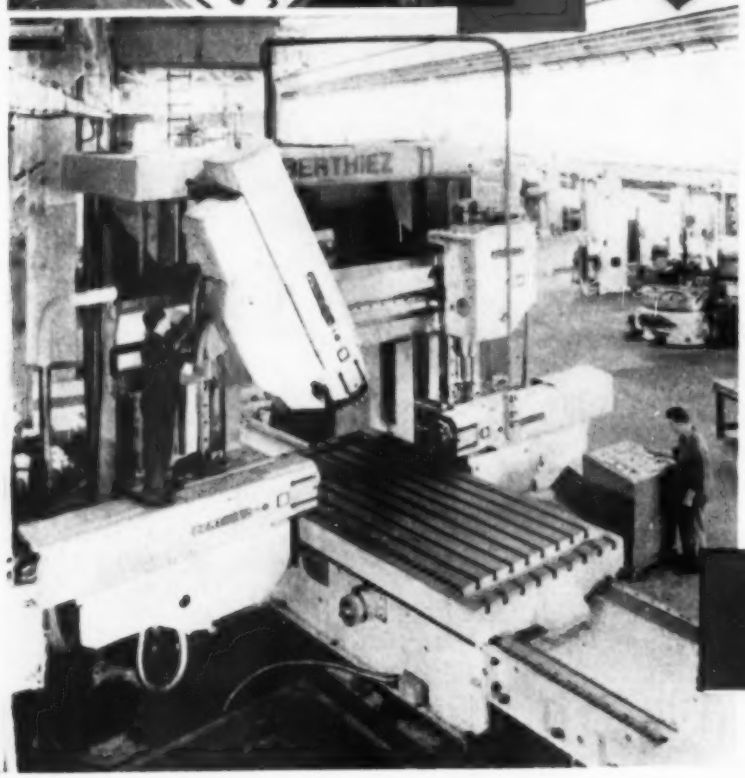
Double Upright Planing
and Milling Machine type R F 2 - 200





Single Upright Planing Machine
type 9120

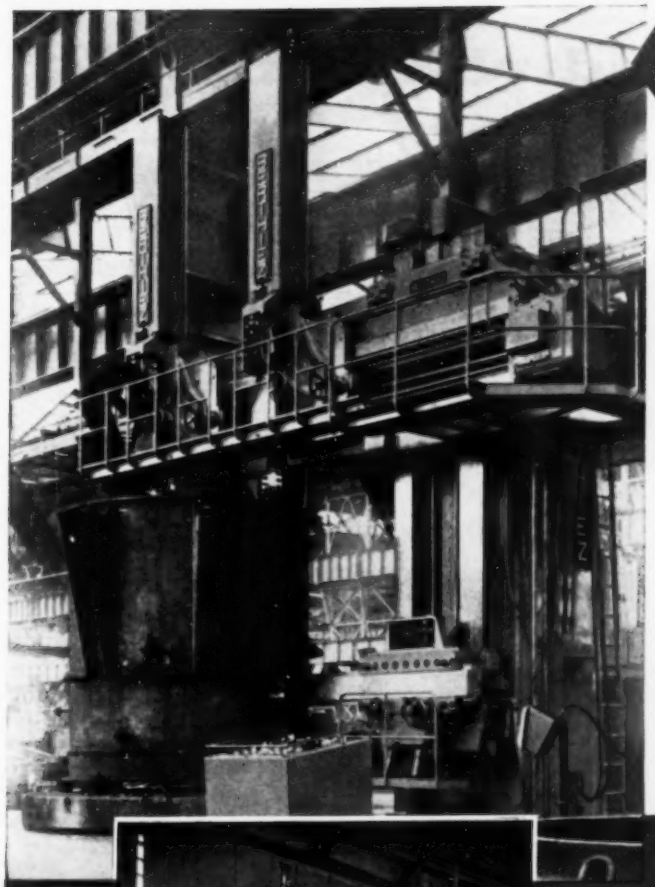
Double Upright Plano Milling Machine
type F 2 - 200



All BERTHIEZ
Planing Machines
plane both ways i. e.
cut coming and going

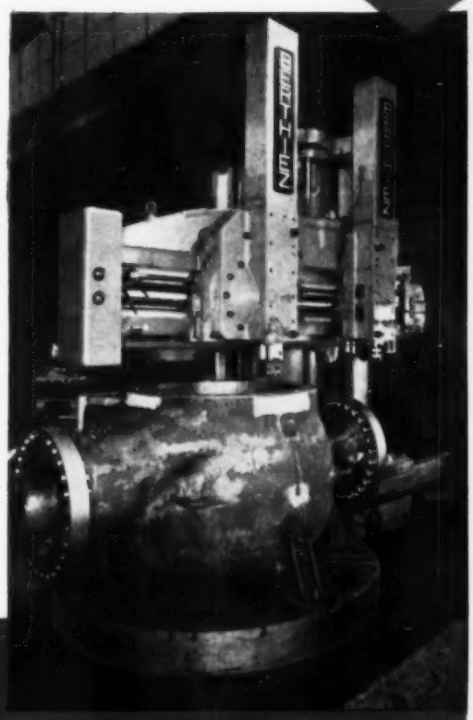
◄ CIRCLE 234 READER SERVICE CARD

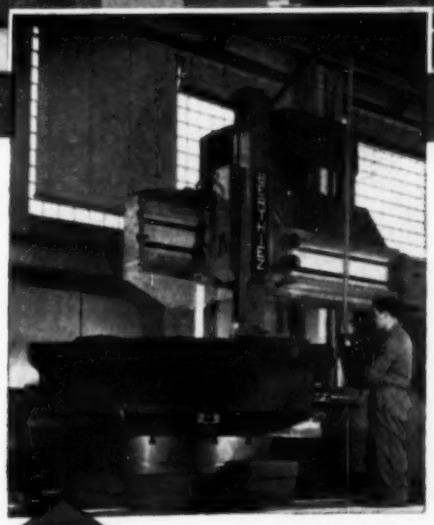
CIRCLE 235 READER SERVICE CARD



Vertical Boring and Turning Mill
type 9375

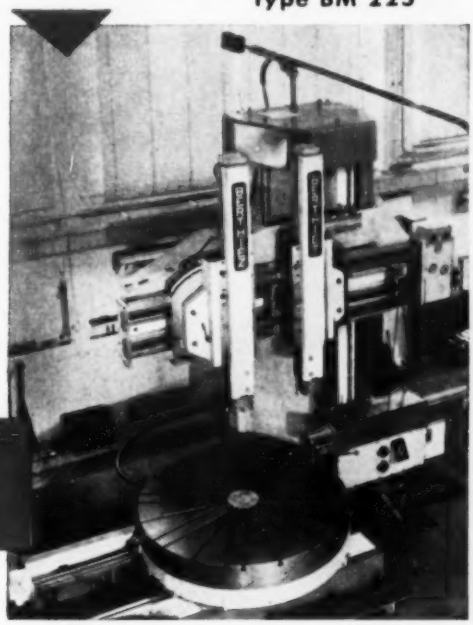
Vertical Boring and Turning Mill
type 9135





Vertical Boring
and Turning Mill type BML180

Vertical Boring and Turning Mill
type BM 225



BERTHIEZ

11, RUE MONTALIVET - PARIS 8e - TÉL. ANJ 47-60

How Ralph Hockett increased diamond wheel life 72%

If ever a man was a perfectionist, that man is Glenn Carr, General Foreman of the Tool Grinding Department at the Wichita Division of the Boeing Airplane Company. And, after fifteen years of working to the kind of tolerances required by the world's leading builder of superbombers, he tends to be skeptical of miraculous claims.

That's why Ralph Hockett of Bay State distributor Wichita Pump & Supply Co., didn't make much fuss about Bay State's new diamond wheels. He analyzed the problem in his usual fact-finding manner, submitted wheels for test and let them speak for themselves.

The result was an eye-opener. The pay-off was in wheel life. Against an average life of *125* hours previously, the new Bay State wheels averaged *215* hours per wheel!

One important factor contributing to this bonus wheel life was the use of Bay State's unique BA Resinoid bond.

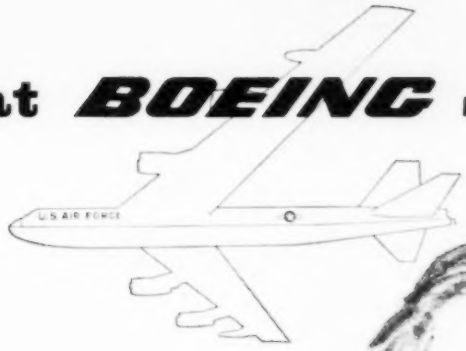
The Bay State wheels were not only longer-lasting but they were more versatile, cooler cutting and gave a far superior finish. They are now, of course, a regular inventory item at Boeing, Wichita, where B-52 missile bombers are in production for the Air Force.

If you have a diamond-wheel grinding problem, you'll find that your Bay State representative, direct or distributor, is ready to supply the right wheel for the job with either natural or man-made diamond abrasive ... and he may well be able to give you a significant improvement in performance, too. Better grinding at lower cost ... that is his business.

This new catalog, which includes pricing data, gladly sent on your request. Ask for Form 217.

Operator Harvey Johnson checks the finish on carbide-inserted tooth of a milling cutter after grinding with Bay State's 215-hour (average life) diamond cup wheel. Glenn Carr, General Foreman, checks Johnson's reading against blueprint.

at **BOEING** WICHITA

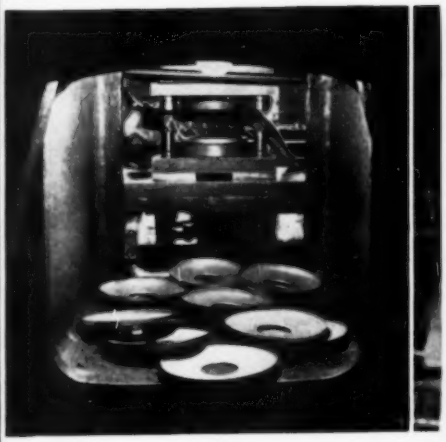


You don't get to know the aircraft business overnight and Ralph Hockett is the first to admit that he has never stopped learning. 27 years as an abrasive specialist, with 19 of them servicing Boeing on everything from the early B-17s on up, have given him what you might call a substantial background in the industry.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Chicago, Cleveland, Detroit, Pittsburgh, Los Angeles. *Distributors:* All principal cities.



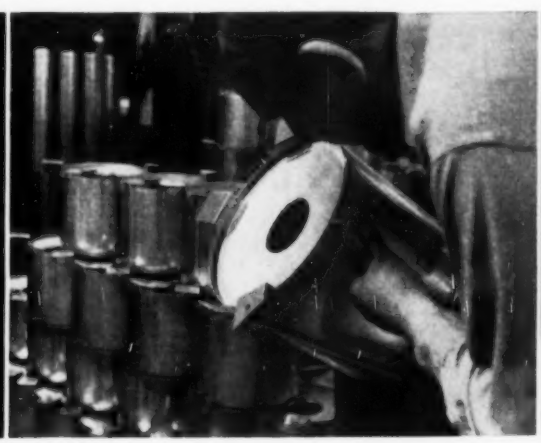
American Furnace hearths now made of USS Stainless Steel

The hearth of an oil furnace may glow at 1500°F. American Furnace Company used to make their hearths from fire brick, and these hearths were usually installed after the furnaces were delivered to the customers.

The company finally switched to Stainless Steel hearths because Stainless Steel *simplified* fabrication. It could be quickly cut, rolled, drawn and welded into a hearth that could be installed right at the factory. And the Stainless Steel doesn't absorb or insulate the heat. It transfers the heat faster, so it increases the combustion efficiency of the unit. It's safer . . . won't absorb oil, and it *cools* quickly, so there's less chance of accidental fire or explosion in the furnace.

When *you* need a material that's corrosion resistant, strong at high temperatures, and not difficult to fabricate, specify Stainless Steel. And for service-tested quality, specify USS Stainless Steel. Call the nearest office of United States Steel or your local Stainless Steel distributor.

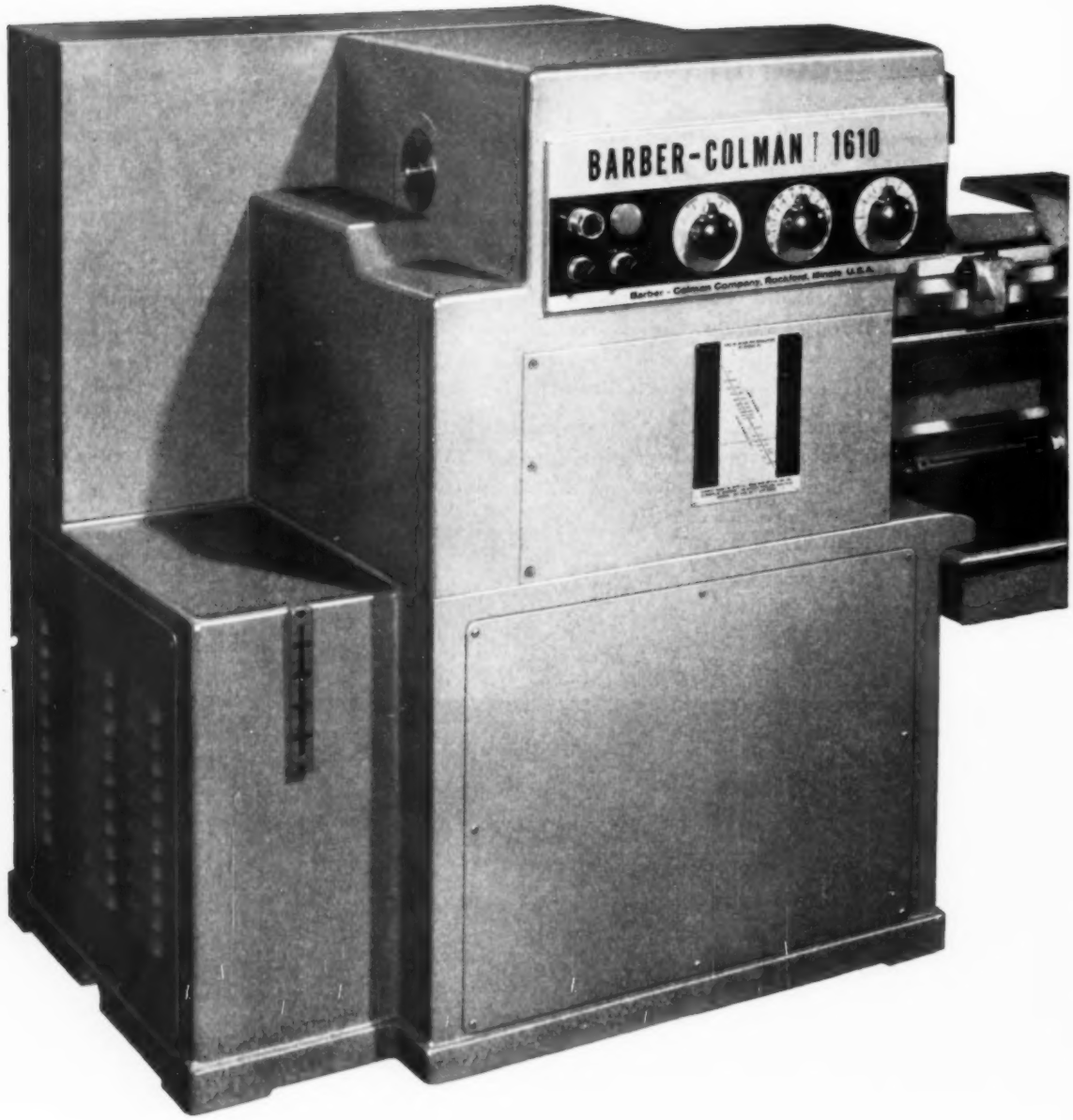
USS is a registered trademark



USS

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

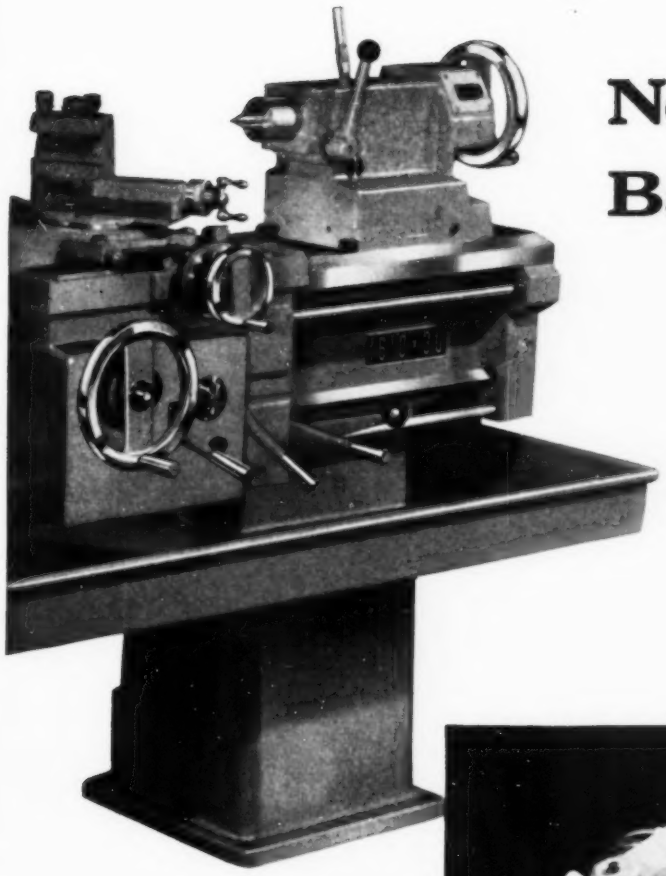


The new Barber-Colman Model 1610 Facing and Turning Lathe is designed specifically for facing, turning, and boring. It is highly economical for either toolroom or production work.

This lathe has no threading equipment. This means more lathe per dollar for your facing and turning work. It can be furnished with a front-mounted tracer that is ideally suited for both small-lot and high-production turning. Either 16" or 20" swing over the bed ways is available.

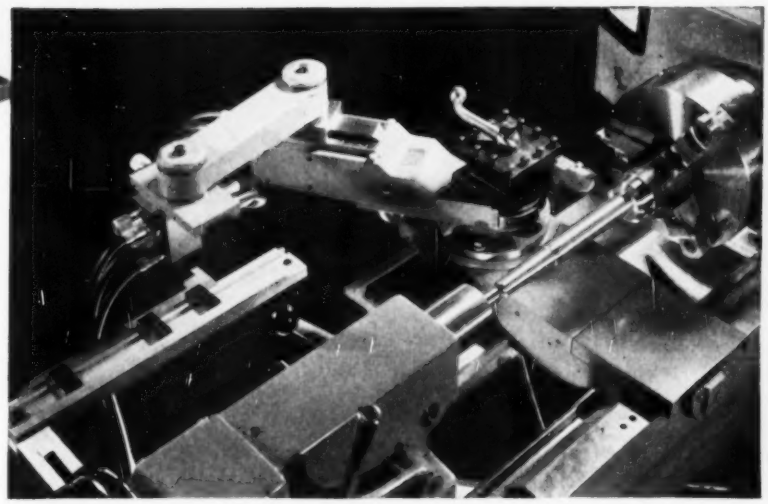
Today, a high percentage of lathes are used only for facing, turning, and boring. Thus, elimination of threading equipment and the gear box permits a sizable saving in purchase price with no practical loss of utility. You get a low-cost precision lathe capable of producing toolroom accuracies easily.

Elimination of the gear box permits infinitely variable feed. Feed rate is changed simply by turning a dial on the headstock. It can be as fine as .0001", depending upon spindle speed. Spindle speeds also are infinitely variable. Maximum speed can be 1500, 2000, or 2500 rpm. The drive motor is 6.5 hp.



New Barber-Colman Lathe

Model 1610 Facing and Turning Lathe . . . 16" or 20" Swing



Model 1610 Lathe with front-mounted tracer unit.

Other important features include automatic carriage stops with a 5-position turret stop, and a tailstock travel counter.

The simple hydraulic tracer is easy to mount, easy to set up, and easy to operate. Stepped diameters, 90° faces, chamfers, contours, and tapers all can be turned at the lowest possible cost. The tracer is front-mounted and uses a flat template. With it, parts can be turned easily within .001" on diameter and .001" on length. Swing over the cross slide with tracer is 10" on the Model 1610 and 13" on the Model 1610-13.

Ask your Barber-Colman representative about the complete features of this new practical kind of lathe. Or write direct to the factory for more information.

Barber-Colman Company

BARBER COLMAN ®

111 Loomis Street, Rockford, Illinois

CIRCLE 242 READER SERVICE CARD

Jigs and fixtures "traded" for tape

$44,954 savings first year

James Rowley, superintendent of the milling and grinding machine group at Brown & Sharpe Mfg. Co., Providence, Rhode Island, expects his new Giddings & Lewis tape-controlled horizontal boring, drilling, and milling machine to pay for itself in a hurry.

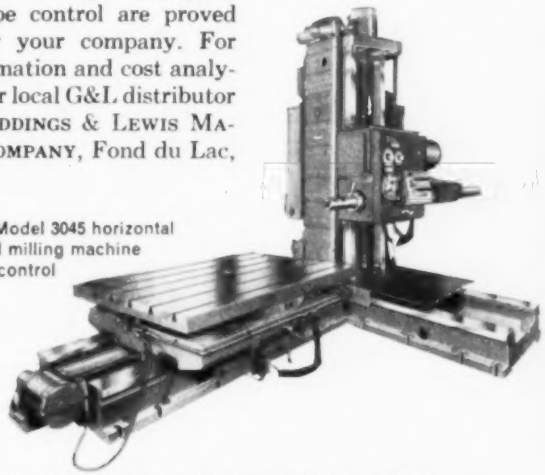
Savings in production hours are running at the rate of $8,594 per year on jobs like those illustrated at the right. On the same jobs, net savings in tooling have totaled $36,000.

Programing requires no special skills or capabilities — a knowledge of part layout and job setup is all that is required to prepare data. Programing and preparation of tapes for many jobs can be done within several hours.

Economic justification for the Numeripoint*-controlled G&L was an open and shut case when Brown & Sharpe faced the cost of tooling for production of a new line of machines. It quickly was determined that the tons of jigs and fixtures required could be "traded" for the new tape-controlled machine. Added advantages of tape: greatly reduced lead time, freedom to modify design almost at will because of the moderate cost involved, reduced handling, lower unit production cost, improved accuracy, and reduction in human error.

Giddings & Lewis tape-controlled horizontal boring, drilling, and milling machines are providing competitive advantage for manufacturers of power generation equipment, printing presses, construction machinery, machine tools, and transportation equipment.

The direct savings and plus-benefits of tape control are proved and ready for your company. For complete information and cost analysis, consult your local G&L distributor or write to GIDDINGS & LEWIS MACHINE TOOL COMPANY, Fond du Lac, Wisconsin.



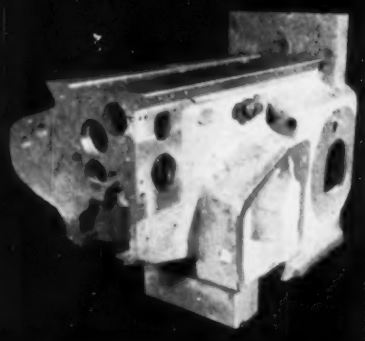
Giddings & Lewis Model 3045 horizontal boring, drilling, and milling machine with Numeripoint* control and rotary table.

* Numeripoint is the G&L trade-mark for its punched tape discrete positioning system.

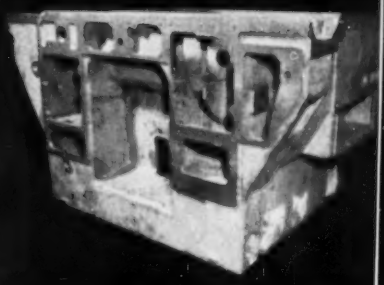
GIDDINGS & LEWIS

Giddings & Lewis manufactures: vertical and horizontal boring machines, vertical turret lathes, planers, planer mills, contour milling machines, die sinking machines, drilling machines, numerical and tracer control systems, boring tools and related items, and machine tool accessories.

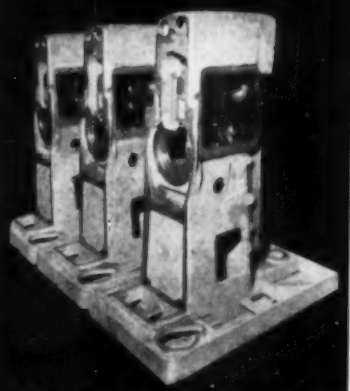
78% timesavings in machining arbor yokes.



42% savings in production time on this milling machine knee were achieved principally through reduction in handling.



38% savings in unit hours on this grinding machine bed proved the advantage of tape control over a specially set up rotary table machine.



50% savings in production time on these milling machine stands — milling, rough and finish boring, drilling, and tapping. Each of the four sides is machined automatically by 90° rotations of the table.

Balance

ADDS

CUTTING LIFE

An almost perfect balance of *toughness, red hardness* and *wear resistance* enables duMont Tool Bits to hold a keener cutting edge longer, gives you a bonus of cutting life in every bit.

duMont

TOOL BITS

High Speed Ground Square and Rectangular

Fill in the coupon below to get full information. Make your own performance tests and see what a difference *balance* can make.

MAIL TODAY - SAVE TOMORROW

The duMONT CORPORATION, Greenfield, Mass.

MAIL FREE Tool Bit COMPARISON CHART, CATALOG and PRICE LIST A

Name.....

Company.....

Address.....

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

More on Delrin castings

Dear Sirs:
In a recent issue, AMERICAN MACHINIST made reference to the use of die-casting machines for the molding of Du Pont's new thermoplastic, Delrin acetal resin (*AM*—June 29 '59, p54).

Since then a number of your readers have queried us regarding the conversion of die-casting machines for use with Delrin.

Actually, Du Pont has not meant to imply that Delrin has been molded in die-casting machines; rather, that die-casting molds have been used in plastics injection machines to obtain sample parts of Delrin.

It does not appear to be practical to convert die-casting machines for use with plastics. However, the machinery manufacturers are the best authority in this matter and should be consulted.

K. J. Persak
Polychemicals Dept, Du Pont Co
Wilmington, Del

Surface finishes

Dear Sirs:
We are interested in purchasing over 100 copies of the articles entitled "Surface-finish measurement on nonferrous materials" (*AM*—Aug 10 '59, p105).

Please send us a quotation covering the quantities of 100, 150, and 200 copies.

Edgar W Bolles
Ann Arbor, Mich

Copies of this Special Report are available from our Reader Service Dept at 35¢ per single copy or 33¢ per copy in lots of 100 or more —Ed.

Spread the know-how

Dear Sirs:
Many thanks for giving my Practical Idea, "Work-holding Fixture Simplifies Silver Soldering" such excellent treatment (*AM*—Aug 10 '59, p130). I hope it provides a stimulus to others who may have a gadget or practical idea.

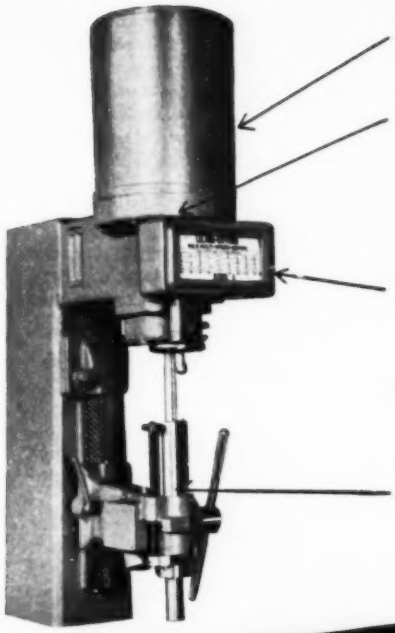
I'm sure there are many ideas that would help us accelerate our struggle for economic survival, but that are never brought to light for various reasons. Many ideas are buried in company archives even though the company has no use for them.

I don't think America is too far behind in creative talent, but it should make more use of what

SHOPMATES

N. Jarvis

HEY! HOW COME YOU GUYS THROW GOOD EMPTY DRUMS AWAY?? WE KIN MAKE A TANK FER DE GREASIN' STUFF — AN' A BOLT BIN — AN' A SCRAP CAN — AN' A COUPLE PIZZA TINS!!
WE ALREADY GOT MORE JUNK IN HERE THAN THERE IS OUT ON THE SCRAP PILE!!
— I'M IN FAVOR OF MOVIN' OUR BENCHS OUT THERE!
KLANG
N. Jarvis



1. TOTALLY ENCLOSED MOTOR

Windings and air gap completely protected from dust, dirt, chips.

2. DIRECT DRIVE

Direct drive from four-speed motor to spindle for smooth power transmission. For extreme speed range, can be furnished with back gears. Speeds from 90 RPM up to 3600 with torque multiplication up to six times supplies brute power for large drills, ample speed for drills down to 1/16".

3. INDICATING SHIFT

For positive speed indication. Tells right speed to use for drill sizes in three different SFM ranges. Convenient hand wheel shifts speed without stopping machine.

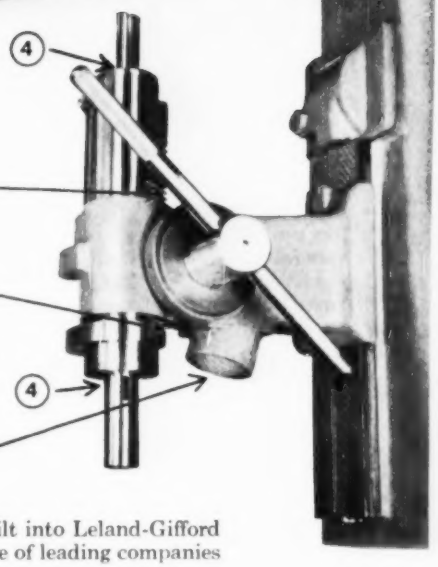
4. OIL MIST LUBRICATION

Radial-thrust ball bearings are constantly and properly lubricated at all speeds by oil mist. Spindle splines lubricated by felt wipers.

5. OVERSIZE SPINDLE QUILL

Oversize quills are 2 9/16" in diameter. Large bearing area maintains accuracy and assures long life.

Only LELAND-GIFFORD Drilling Machines have all these Precision Features



6. INSERTED STEEL RACK

Inserted steel rack prevents radial motion which can cause uneven tooth loads on feed pinion. Also insures accurate alignment when multiple heads are used.

7. BROACHED SLOT

Rack slides in slot precision broached into head.

8. SPINDLE GUARDS

Telescopic guard can be furnished to completely cover the spindle, protect operator from fast-moving multiple splines.

9. BUILT-IN LIGHT

Built into sliding head. Puts the light on the work where it ought to be. Never in the way like makeshift lighting.

Compare the quality, workmanship and precision features built into Leland-Gifford Drilling Machines and you will see why they are the first choice of leading companies for toolroom and production lines.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U. S. A.

Branch Offices:

CHICAGO 5
2515 W. Peterson Ave.

CLEVELAND 22
P. O. Box 853

DETROIT 21
10429 W. McNichols Rd.

INDIANAPOLIS 6
P. O. Box 1051

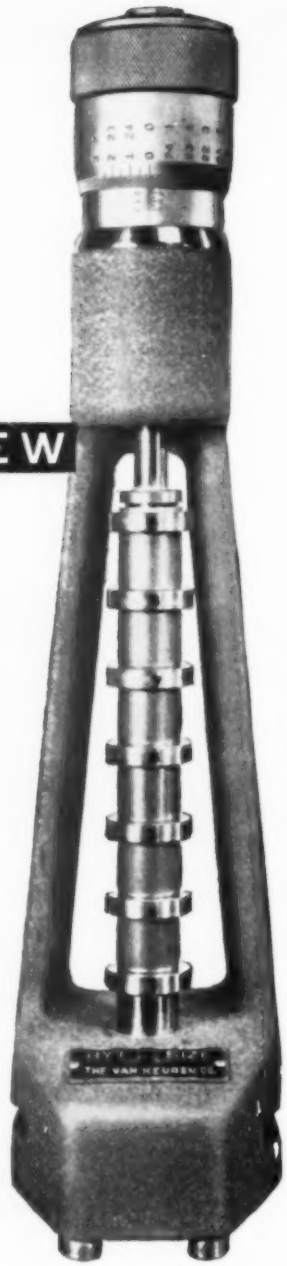
LOS ANGELES
2620 Leonis Blvd., Vernon 58, Cal.

NEW YORK
75 S. Orange Ave., South Orange, N. J.

ROCHESTER 12
P. O. Box 24, Charlotte Station

HYT Size Gage, 10" model

Available accessories:
18" transfer gage
3" and 6" riser blocks



Your surface plate needs this **NEW** dimensional gage, the **VAN KEUREN HYT SIZE GAGE**

Here's why:

- it embodies the well-known *Van Keuren precision.*
- it has a decided price advantage.
- permits amazing speed in setting all dimensions (a matter of a few seconds!)
- it's accurate to .000050" over entire range.
- has exclusive design features: a patented spring-loaded non-rotating spindle eliminates backlash . . . measuring surfaces are accessible from front and back . . . it can be used in a horizontal position.
- it's ruggedly built for long life.
- easily portable . . . can be used anywhere in shop.

Now you can more quickly inspect drill jigs, lathe fixtures, gears, cams, splines, profiles, contours . . . and check many shop operations. You can easily set precision depths on drill presses, milling machines, jig borers, etc.

Write today for descriptive bulletin

THE Van Keuren CO.
Since 1920
173 Waltham Street, Watertown 72, Mass.
PRECISION MEASURING TOOLS
. . . rated the world's most accurate
Plug Gages · Measuring Wires · Optical Flats and Light Wave Equipment · Gage Blocks · Precision Lapping Service and Parts

it presently has. We cannot depend on a father-to-son handdown of skills. We've got to teach more people to do more things, and we don't have much time!

However, before we can expect any avalanche of new ideas, we've got to accelerate our communications—get our ideas out where they will do some good.

Samuel J Yasho
Los Angeles, Calif

An overstatement

Dear Sirs:
In your "Metalworking Report" (*AM*—Aug 10 '59, p3) you printed information on the work which Lukens has been doing on titanium-clad steel.

Our work on titanium-cladding steel is, at present, in the research and development stage. While a good deal of progress has been made, problems still exist before this product can be considered commercial in any sense of the word.

The article which you published has caused much concern, because it might give an erroneous impression of Lukens Steel Company which has prided itself for 150 years on not only being first but "first being right." At this time we cannot predict as to when this product will be commercially available.

Joseph H Proctor, *manager*
Application Engineering Dept
Lukens Steel Company
Coatesville, Pa.

We are sorry we did not make it clear that titanium-clad steel is still in the development stage at Lukens—Ed.

"Better tell me what's in those 'just before pay day sandwiches', dear—I may have to describe it to the doctor."

CALENDAR

American Society of Mechanical Engineers — Annual Meeting, Nov 29-Dec 4, Chalfonte-Haddon Hall, Atlantic City, NJ

Drop Forging Association—Winter Meeting, Dec 6-9, Savoy Hilton Hotel, New York, NY.

Joint National Symposium on Reliability and Quality Control—Jan 11-13, Statler-Hilton, Hotel, Washington, DC.

Plant Maintenance & Engineering Show & Conference—Jan 25-28, Convention Hall, Philadelphia, Pa.

Society of Vacuum Coaters—Annual Meeting, Jan 26-27, Hotel Biltmore, New York, NY.

Instrument Society of America—Instrument Automation Conference and Exhibit Feb 1-5, Houston Coliseum, Houston, Texas.

Society of the Plastics Industry—Reinforced Plastics Div Conference, Feb 2-4, Edgewater Beach Hotel, Chicago, Ill.

Armour Research Foundation and American Welding Society—Annual Midwest Welding Conference, Feb 3-4, Illinois Tech Chemistry Bldg, Chicago, Ill.

American Society for Metals—Golden Gate Metals Conference, Feb 4-6, Fairmont Hotel, San Francisco, Calif.

American Institute of Mining, Metallurgical, & Petroleum Engineers—Annual Meeting, Feb 14-18, Statler and McAlpin Hotels, New York, NY.

Annual Joint Conference on Automatic Techniques (ASME, IRE, AIEE—Apr 18-19, Cleveland-Sheraton Hotel, Cleveland.

American Society of Tool Engineers—Tool Show, Apr 21-28, Detroit Artillery Armory, Detroit, Mich.

American Welding Society—Annual Meeting and Welding Show, Apr 25-29, Great Western Exhibit Center, Los Angeles.

American Society for Metals—Southerwestern Metal Exposition and Congress, May 9-13, State Fair Park, Dallas, Texas.

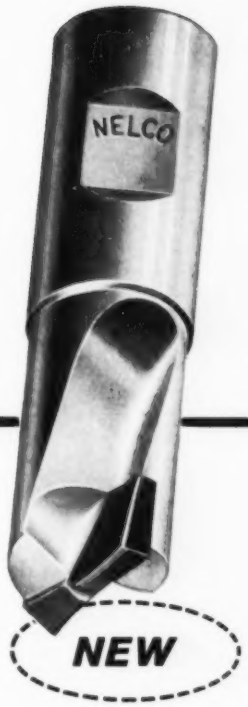
again . . .

NELCO

END MILLS

LEAD IN CUTTING

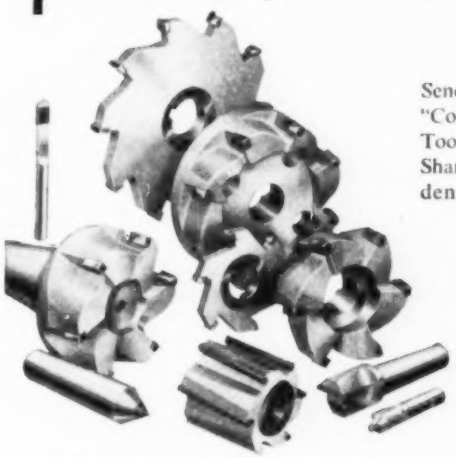
ALUMINUM



This new true helix end mill is the *first* of its kind–Nelco engineered to give superior production performance when plunge cutting and general purpose milling on Aluminum.

Generous carbide tips are ground to give free shearing action, excellent surface finish in plunge and slotting cuts. Short length, added flute strength, greater chip clearance produce a new versatility and dependability on rugged cutting operations.

Standard stock available from your distributor in sizes up to 1" in diameter.



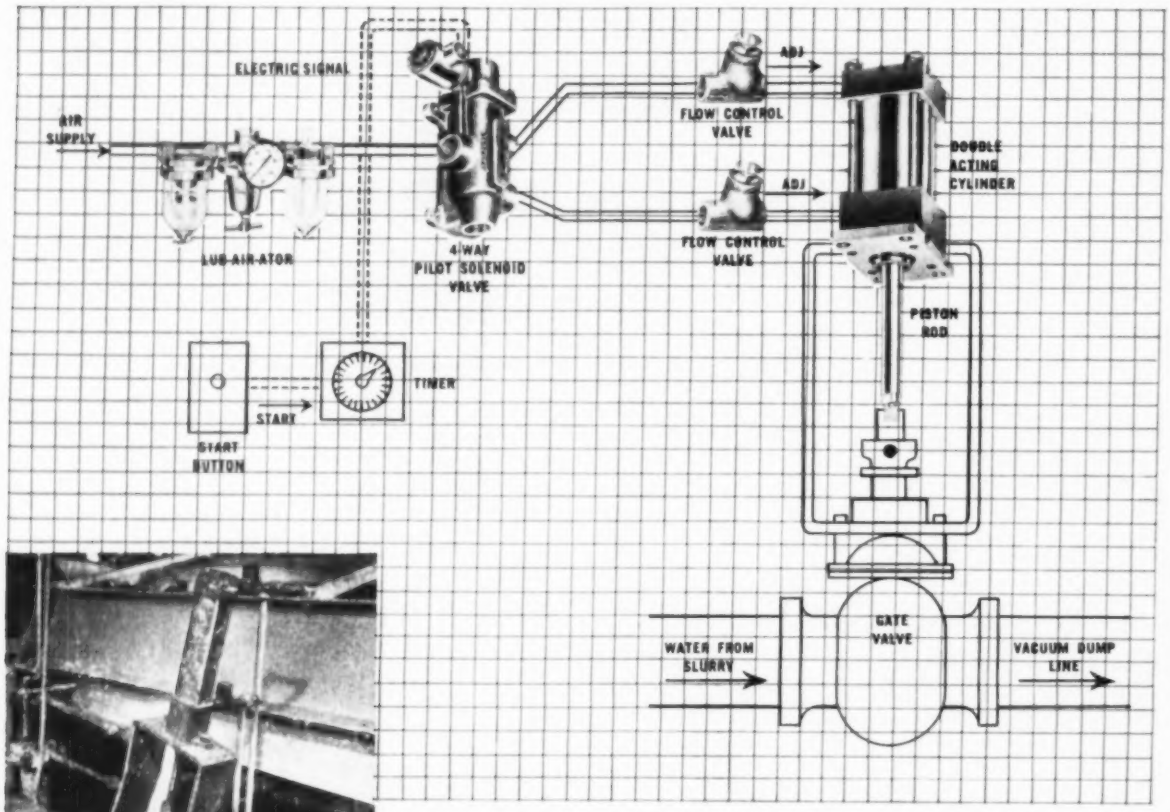
Send for your copy of the "Condensalog" to Cutting Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

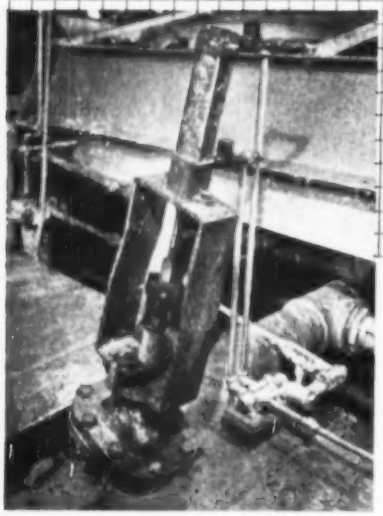
For that EXTRA Edge in Production . . . specify NELCO, Pioneers in Superior Carbide Tooling.

Brown & Sharpe
HIGH SPEED STEEL CUTTING TOOLS

NELCO
CARBIDE CUTTING TOOLS

PROCESSOR SPLITS PRODUCTION BOTTLENECK WIDE OPEN WITH HOOKUP OF STANDARD SCHRADER AIR PRODUCTS





Here's how one company automates with air. The hookup of Schrader Air Products in the large diagram actuates gate valves used in processing a slurry of raw asbestos fiber and cellulose at The Republic Seitz Filter Corporation, Newark, N. J. This used to be a slow, arduous manual job. Now air does it quickly, effortlessly, under "conditions particularly difficult for most kinds of automatic equipment . . . without a minute's downtime and without any maintenance whatever," says the company's Technical Director. Schrader-trained air specialists helped plan this practical set-up, as they have helped plan countless others.

Boost productivity of even complex operations quickly and economically, like this company . . . with *air!* Plan it yourself, or let our experts help. A system of Schrader Air Products can simplify almost any bottleneck job . . . whether it's processing, assembling, testing or packaging . . . pushing, pulling, holding, positioning or moving work repetitively.

With Schrader Products, you can run practically any production line faster, safer, more economically—and with tireless accuracy! Maintenance is surprisingly low.

These are benefits every shop needs. Take advantage of them all when you automate with Schrader . . . the finest, the most complete line of Air Cylinders, Valves and Accessories . . . plus countless ideas for cutting your operating costs.

Select air controls from the full Schrader line. Your Schrader distributor can help you pinpoint what you need. For more data, write:

Schrader®
a division of SCOVILL

A. SCHRADER'S SON
Division of Scovill Manufacturing Company, Incorporated
460 Vanderbilt Avenue, Brooklyn 38, N. Y.

QUALITY AIR CONTROL PRODUCTS

CIRCLE 249 READER SERVICE CARD

CIRCLE 250 READER SERVICE CARD ►

Cuts 10 Times Faster, Lasts 30 Times Longer

STARRETT SAFE-FLEX® HIGH SPEED STEEL BAND SAW

Here is a high speed steel band saw that cuts up to 10 times faster, lasts up to 30 times longer than ordinary blades. New heat treating techniques give it graduated hardness from super-hard teeth to super-tough, flexible back. New welding methods make the weld as strong as the parent metal.

Starrett Safe-Flex® High Speed Steel Band Saws have red heat hardness that permits using heavier feeds, higher speeds. They stay hard even at temperatures up to 1100°F. New tooth and gullet design, thinner section, plus sharp, precision cut teeth assure straight, accurate cutting, a fine finish, minimum metal removal. Recommended for all cut-off work on tool and die steels, ferrous alloys and hard-to-cut non-ferrous metals . . . also for severing and slicing operations.

Your nearby Industrial Supply Distributor has Starrett Safe-Flex® High Speed Steel Band Saw Blades in regular, skip-tooth and hook-tooth types. He also stocks the complete Starrett line of hacksaws, hole saws, band saws and band knives. Call him for quality products, dependable service . . . or write for complete information. Address Dept. C, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

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BAND SAWS • BAND KNIVES
HACKSAWS • HOLE SAWS

World's Greatest Toolmakers

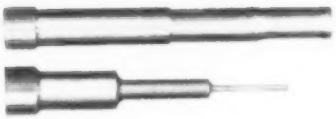
Starrett Precision Makes Good Products Better

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLESAWS • BAND SAWS • BAND KNIVES

CLEVELAND 1⅝" DIALMATIC

"Increased production 500%", reports Decker Nut Mfg. Corp.

With *dial control* of infinitely variable spindle speeds and turret tool feeds, this 1⅝" Model AB Cleveland Single Spindle Automatic has increased production 500% on close tolerance machining of cold heading tools for Decker Nut Mfg. Corp. Typical tools are shown below. Shown at the machine are R. R. Hunt, foreman, and B. L. Konkle, operator and set-up man.



TOP—Long pierce punch (H. S. Steel) machined in 5 operations. Cleveland time: 20/hr. gross. Lathe time: 7/hr. gross.

BOTTOM — Short pierce punch (H. S. Steel) machined in 6 operations. Cleveland time: 17/hr. gross. Lathe time: 7/hr. gross.

Square die (High C. High Cr. Die Steel) machined in 7 operations. Cleveland time: 10/hr. gross. Lathe time: 22 min. each.

Nose die (Cr-W Tool Steel) machined in 7 operations. Cleveland time: 9/hr. gross. Lathe time: 25 min. each.

DECKER NUT MANUFACTURING CORP.
Manufacturers of
COLD HEADED INDUSTRIAL FASTENERS
Albion, Michigan

Cleveland Automatic Machine Company
Cincinnati, 12, Ohio

Gentlemen:- Attention: Mr. Prohaska

The 1-5/8 Dialmatic which we purchased recently has resulted in substantial savings in our toolroom cost. These savings were realized immediately. Where we had been using lathes to make tools for our cold-heading equipment we now use the Dialmatic completely.

The use of this machine has increased production of tools at least 500%. Coupled with the savings in time and labor we have reduced the possibility of human errors to practically nothing. This machine runs exclusively on tool steels at very close tolerances.

Our satisfaction with your equipment would not be complete without mentioning the fine cooperation that we receive from your sales and service people.

Should it be necessary to increase our facilities along this line, your equipment will most certainly be our choice.

Yours very truly,

DECKER NUT MANUFACTURING CORP.,

Edwin W. Konkle

Edwin W. Konkle
Pres. & Gen. Mgr.

EWK/CT

Let a Cleveland field engineer show *you* how *Clevelands Cut Costs!* For machine specifications write for General Bulletin.

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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

SPOT NEWS...

- **Boeing-Wichita is going into the numerical control business.** It will offer a subcontracting service for parts programming, computing, tape preparation and verification, tool design and fabrication and, in some cases, parts fabrication. Any or all of these services are now available. Boeing-Wichita, incidentally, now has 15 numerically controlled machine tools in operation, including five Milwaukee-Matics.

- **Two-year program for training specialists** in various types of metalworking jobs (surface grinder or jig borer operator, for example) is being advocated by some members of National Tool & Die Manufacturers Association, is opposed by others. Proponents argue that this would produce much needed skilled workers in less than the regular four-year apprenticeship course. Opponents say this would discourage young men taking the full 4-year apprenticeship course, because such specialists would ultimately earn almost as much as a full T & D journeyman.

- **Cast aluminum auto muffler that should outlast the car** has just been developed by Centr-O-Cast Engineering Co, Detroit, will go on the replacement market by year's end. Its cost will be $18.50, as opposed to $15 for a sheet steel muffler.

- **Air Force contract to evaluate ultrasonic techniques in grinding** has been awarded to Sheffield Corp, Division of Bendix Aviation Corp. Study will deal with ultrasonic vibration techniques for grinding high-strength alloys for aircraft and missiles on conventional grinding machines.

- **Cost of purchasing automotive tools and dies in the Detroit area** is $7.90 per hour, as opposed to $3 an hour in England, and as low as $2.38 in France, and $1.60 in Milan, Italy, according to Ford Motor Co VP Irving Duffy, speaking recently in Philadelphia.

- **A small business "defense production pool"** has just been formed in California with the approval of the Small Business Administration. Unified Industries, a group of 11 small metalworking firms in the Los Angeles area, now offers area prime contractors "a soundly managed group of skilled small industries capable of fulfilling all specifications and requirements" for "almost any type of government production from design and development to complete fabrication, wiring and final assembly."

- **Auto plants are pulling back more and more work** into their captive shops and on such contracts as they do let out, are asking for five bids now instead of the normal three—three from union shops and two from non-union shops. Shops, consequently, are being forced to cut as much as 25% off their usual prices to meet competition.

- **India has just designed a low-priced utility automobile** to sell for around $1050. Car has a glass-fiber-reinforced plastic body, has a forced draft cooling system, torsion bar suspension, achieves 55 mph. Said to be eliminated are tappets, valves, timer, and rear axle.

- **New "dry phosphatizing process" developed by DuPont** and introduced at the Metal Show (see p126) gives a phosphate coating to metal parts by dipping with a special solution heated to 188 F, which leaves parts dry and ready for immediate painting. Works on steel, aluminum, magnesium, zinc and other metals.

- **Auto industry changeover for 1961 models will be the biggest in years.** Changes will involve much more than styling, will go into important engineering changes. And if the U S compacts go over as expected, a major reshuffling of nameplates is possible in the future.

...see how this new ROTOR PENCIL GRINDER excels all others

- **THE FIRST BLADED TYPE AIR-POWERED PENCIL GRINDER** . . . now vastly improved . . . the New Rotor M1223 D-03S. Features:
- **NEW FULL-GRIP COLLET.** "Rubberflex" collet grips shank entire ½" length. Takes wider range of shank tolerances. Holds shank concentrically . . . minimizes "runout" to .002", reducing vibration, prolonging point and cutter life.
- **FRONT EXHAUST** . . . away from operator. Keeps work clean. Collet shrouded by exhaust deflector. (Side exhaust optional.)
- **STURDIER CONSTRUCTION.** Rugged, one-piece spindle and ball bearings of ample size assure long life, smooth operation, reduced "runout". Splined drive of rotor to spindle is stronger, gives better dynamic balance.
- **MORE POWERFUL BLADED MOTOR** (not a turbine). Full 40,000 rpm gives plenty of power for ½" diameter mounted points and burrs, or cutters. Greater power under load for higher cutting efficiency.
- **TRY IT!**—ask for free demonstration of the New Rotor M1223 D-03S Pencil Grinder!

Optional end cap with side exhaust (arrow).

ROTOR TOOLS
CLEVELAND, OHIO

Here's the RIGHT TOOL for YOUR job!

ROTOR AIR TOOLS: Assembly Tools • Drills • Small Wheel Grinders • Straight Grinders • Vertical Grinders • Scalers • Chippers • Rammers • Special Tools • Air Motors
ROTOR HIGH-CYCLE ELECTRIC TOOLS: Grinders • Polishers • Sanders

WASHINGTON...

Foreign economic policy shift...

A fundamental shift in U S foreign economic policy is shaping up. It is bound to have a long-term impact on the overseas business of metalworking equipment producers.

- **Future loans of the Development Loan Fund** —main channel for U S government economic aid to neutral underdeveloped nations—will be tied to purchases of American equipment wherever possible.

Up to now, development loans could be spent anywhere, and nearly half has been for purchase of foreign goods.

- **A similar policy may be adopted for ICA** loans and grants to U S military allies in support of military programs. But the State Department is resisting this.
- **An attempt will be made** to cut U S military expenditures abroad and to shift some of the cost of U S foreign bases and troops to allied governments.
- **Washington is pushing other nations hard** to scrap remaining discriminatory restrictions on imports of U S machinery and other goods.

Background for the shift...

Behind this shift is a profound and perhaps permanent change in the international economic position of the U S. From being the world's greatest creditor nation, the U S has become its leading debtor during the past few years.

Last year we paid out $3.4 billion more in gold and dollars than we received. This year the deficit will be $4 billion or more. At this rate, foreign claims on the U S soon would exceed U S gold reserves and the stability of the dollar would be threatened.

This turnabout reflects the recovery of Europe and Japan, which are competing so successfully (both here and in third markets) that the U S no longer earns through trade the whopping surpluses needed to cover foreign military spending, foreign air, and investment.

Another shakeup in space...

The administration's latest shakeup in the space program—switching the Army's famed Space Laboratory at Redstone Arsenal, Huntsville, Ala to NASA—now gives the civilian agency indisputable control over all space projects not specifically tied to weapon systems.

This covers rocket shoots to the moon, deep space probes, design and development of a wide range of scientific earth satellites and specially instrumented lunar and interplanetary payloads, and development of the super rocket boosters needed to launch these vehicles.

The Huntsville transfer is likely to have a considerable impact on the civilian Space Agency's dependence on metalworking contractors for design and development of astronautic systems and components. For NASA has acquired a wide range of facilities—fabrication and assembly shops, engineering labs, and the like—which can provide capabilities that compete with the services of some of the Agency's industrial contractors.

How much of an impact is still too early to determine. One official stresses the Huntsville transfer will not reduce NASA's dependence on outside contractors. But at the same time he points out that the Agency's "in-house" development operations will obviously be greater in scope than before.

New tax rule pending...

Internal Revenue Service has proposed a ruling to control business expenses in the areas of advertising, publications, and lobbying. Under its provisions, funds directed at influencing legislation or political campaigns would not be deductible on either a corporate or personal income tax return.

Spokesmen here for trade associations, private corporations, labor unions, and the like say IRS is drawing too tightly the definition of lobbying as against informing the public. In essence, IRS has given itself the chore of trying to determine for tax purposes just what is a lobbying activity, what is political advertising, and what is institutional public relations.

Unions and rackets...

Labor leaders who thought the new labor anti-corruption law would bring the government in to do all the policing on rules against racketeering are now finding themselves still under pressure to do their own policing as well.

The Carpenters' Union has become a top corruption target with a grand jury indictment of President Maurice Hutcheson for contempt of Congress. The Justice Dept has set up a new "labor rights section" to ride herd on labor racketeering . . . and on Capitol Hill, a permanent watchdog committee is being planned to replace the moribund McClellan Anti-Racketeering Committee to eye union corruption.

no need for Obsolescence

with **BULLARD**

VERTICAL TURRET LATHES

Model 75

In May, 1955, Hyster Company, Peoria, Illinois, installed a 36" Cut Master V.T.L., Model 75 and by the end of 1956 it was evident that due to increased requirements an automatically controlled machine was necessary. *Did this obsolete the Cut Master?* — No sir — it only meant adding a Man-Au-Trol Conversion Unit to Cut Master *right in their plant. And it was accomplished in only four days.* No need to obsolete Bullard Cut Master, Model 75 — just convert them.

another way to cut costs when cutting metal — **buy BULLARD**

Man-Au-Trol installed for automatic control of Turret Head.

36" Bullard Cut Master V.T.L. Model 75 manually controlled from Pendant Control.

Bullard Service Engineer guides Man-Au-Trol Conversion Unit into place.

Electrical connections for Man-Au-Trol are wired into Cut Master Control Panel.

For the complete information on Bullard Vertical Lathes call our nearest Sales Office or Distributor.

THE BULLARD COMPANY

BRIDGEPORT 9, CONNECTICUT

DETROIT...

A bleak November...

General Motors car and truck production has ground to almost a complete halt, idling over 200,000 workers. Ford and Chrysler are stretching dwindling steel supplies by working three and four-day shifts at many assembly plants. Only American Motors and Studebaker now foresee full output through November.

The unexpected longevity of the steel strike has cut a hefty two-thirds out of the industry's originally scheduled November production of 640,000 units. It is interesting to note that GM devoted its last gasps of steel to Corvairs and heavy-duty trucks. These two items represent, respectively, the low and high end of the profit. scale. The company feels that its small car must be produced regardless of sacrifice to get it on the road during the crucial introduction period.

Ford, with its own mill facilities on a 24-hour basis, is actively importing hot rolled coils from Europe. Steel imports for Detroit industry in general have almost doubled since August. The steel tonnage alone already surpasses total imports of all kinds for last year.

Breakthrough in turbines...

Williams Research Corp of Walled Lake, Mich, has developed a 75-hp, 75-lb regenerative gas turbine that the company claims can be put into mass production at a cost more than competitive with diesel or air-cooled aircraft reciprocating engines of comparable output.

For certain military applications, such as lightweight heliocopters, a non-regenerative version will be available that weighs only 25 lbs less. Reasoning is based on Korean War experience, where copter missions averaged less than 30 minutes in length, hardly justifying the added cost and weight of a fuel-saving heat exchanger.

The unit, which is described as being "the size of a bread box," is 50% composed of aluminum alloy die castings. These include gear case, compressor and outer housings. Rotating parts are machined from precision cast ferrous alloys.

A test installation, mounted as an outboard motor in an 18-ft Thompson boat, has been running for 15 months. It will achieve speeds comparable to those of a reciprocating outboard motor of similar horsepower.

Sam Williams, 38-year-old founder and president of the company, says that he plans his own manufacture of aircraft versions in about a year. The unit is scheduled to undergo initial CAA acceptance tests in the near future. Williams has already licensed "several" manufacturers to produce the powerplant for various ground uses, but says that the terms of his contracts prohibit him from disclosing these outlets. Williams before forming his own business was a principal designer of the regenerative turbo-prop engine that Chrysler developed for the Navy's Bureau of Aeronautics, as well as of the basic unit now under development by Chrysler for automotive use. The latter engine has a rotating heat exchanger or regenerator.

Rambler expansion...

AMC, in a move prompted in part by the fact that December dealer orders are up 141% over last year's record, has leased the 2-million sq-ft Simmons plant in Kenosha for additional body production. Conversion to automotive manufacture will be completed within seven months, and will boost the company's capacity to more than 600,000 units a year by the latter half of 1960.

President Romney said that the Simmons arrangement will in no way affect long range expansion plans involving permanent construction. The Simmons conversion alone will cost $14.5 million. In addition, there is a $17.5-million project underway to dual the six-cylinder engine lines at Kenosha, and to expand machine capacity for rear axles and front suspension. At the Milwaukee body plant, $10.5 million has been spent on internal expansion, including additional welding equipment and lengthening of paint and trimlines. 28 acres of land adjacent to the Kenosha engine plant have recently been acquired and earmarked for new construction.

Romney justifiably boasts that all of these programs have been paid for out of current income. Statistics show that 99,209 Ramblers were produced in 1957 and 374,240 in 1959, indicating why this has been possible. Dealer orders for 1960 models currently exceed production capacity.

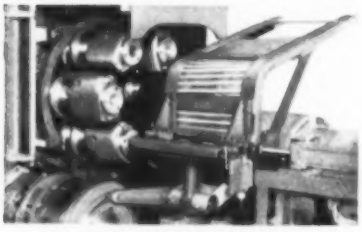
Romney also expects a banner year for his Kelvinator Appliance Division—the fruits of a painful three-year program to bring design up-to-date and ahead of competition. Sales are running 45% ahead of a year ago, a figure well ahead of the general industry gain.

Kelvinator stands second in world production of major appliances (Frigidaire is first). The company actually sells more refrigerators outside the United States than in it. The automotive division is currently studying the European Common Market and is actively discussing merger possibilities with several German and French automakers.

◄ CIRCLE 253 READER SERVICE CARD

Second Operation

MAGAZINE LOADING



REAR LOADING MAGAZINE

HAND LOADING

A Method of Machining That Pays Off

Greenlee standard Automatic Bar Machines, adapted for second operation work, profitably machine a wide variety of parts. Long shafts or short pieces are automatically loaded into the work spindle by any of the various loading arrangements shown. Parts are loaded in one position during the machining cycle, and machined in the remaining five cross slide and end working positions. For more information, see your Greenlee Distributor.

GREENLEE STANDARD AND SPECIAL MACHINE TOOLS

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Die Casting Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines

WRITE FOR CATALOG No. A-405

GREENLEE BROS. & CO.

1744 MASON AVE.
ROCKFORD, ILL.

AIRCRAFT and MISSILES... TRENDS

Giant one-piece missile cases...

Pratt & Whitney Aircraft has just installed a huge 250,000-lb shear forming machine capable of turning out one-piece, weld-free missile cases of record size.

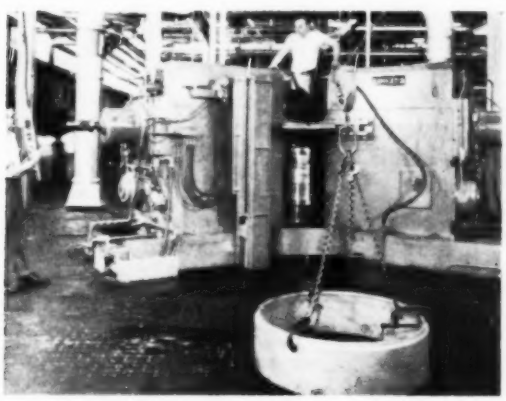
The machine, built for P&WA by Lodge & Shipley, is of vertical design, allowing the part to move upward unobstructed during forming.

By this method, P&WA can turn cylindrical shapes of diameters up to 80 in., more than 20 ft long, with wall thicknesses as little as 0.015 in. (Previous maximum diameter was 66½ in Maximum length was 75 in.)

The new shear-forming machine can work the toughest of metals—high-alloy steels, moly, titanium, tungsten and tantalum—into cylindrical or conical shape by stretching and shaping disks and rings by flowing metal over a mandrel under pressure from high-speed rollers.

The new machine will be used to work missile cases of the new VCA titanium alloy (13% vanadium, 11% chromium, 3% aluminum among other elements). Experimental tests on pressure vessels of this alloy have showed a yield strength equal to 300,000 psi, according to P&WA engineers.

The company now claims it can turn out full-scale rocket cases with consistent yield strengths of 240,000 psi. For one thing, shear forming eliminates welds (a circumferential weld is OK for missile cases, but a longitudinal one isn't) to produce unprecedented strength in the cases.



New allowable cost rules...

Defense contractors have been handed a new set of ground rules for determining allowable costs for defense work. Primarily, the new rules put down in more detail what has been practice over the years.

Although aimed specifically at cost-reimbursement type contracts, the new rules—effective July 1, 1960—will serve as a guide for Pentagon contract administrators on negotiated and fixed-price contracts as well.

Some seven years in the making, the new rules take 46 major cost items and spell out if and how the government will allow costs to be tallied. In some instances, the new policy represents a tightening up of controls. Interest, for example, won't be an allowable item under any type of contract, although it is allowed now in some contracts. In the case of reseach and development, the government is going to be more liberal in cost sharing..

For such items as "special tooling costs," "depreciation," etc, there is little change from the current cost-allowable practice.

Copies of the new "Revision No. 50 Armed Services Procurement Regulation" are available from the Government Printing Office, Washington 25, D C, 35¢.

Polaris spending to jump...

Navy spending for its Polaris submarine-missile program will jump to around $1.6 billion next year. That is the amount the Navy is asking for in its 1961 budget, and reports are the Pentagon will okay the measure. This is a sharp increase over the $600 million being spent this year. But the increase doesn't come from a speedup.

The increase in spending comes from having 12 of the Polaris-toting submarines in various stages of construction. They are reaching the point where expensive outfitting is occurring. Since 1957, some $2.6 billion has been spent on the program.

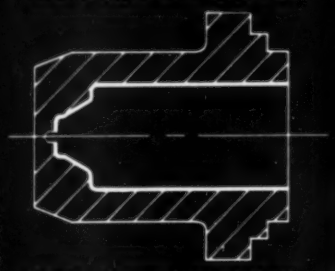
Three of the subs have been launched and are currently undergoing builders' trials. This is primarily a test of the submarine construction and propulsion system. The Navy expects to have the first three submarines at sea in 1960.

Between now and then, however, is when the bulk of the Polaris weapons system will be added to the vessels.

Six other Polaris submarines are under construction now, and long lead time items are being purchased for another three. Right now, Navy doesn't know when it will start construction on additional Polaris subs.

LEFT—Closeup photo shows the .003" radius boring tools and the size of the parts held in the three-jawed diaphragm chucks.

ABOVE—The Style 308 Cam-Operated Precision Boring Machine used in this high-output machining operation.



ABOVE—Cutaway, twice actual size of the part, shows contour of the finished cut. Surface finish is held to 12 RMS.

59-20

BORES AND CONTOURS 184 PARTS PER HOUR

Style 308 Cam-Operated Precision Boring Machine finishes small stainless steel parts to 12 RMS

Speed and precision in continuous, close-tolerance production of contoured parts come easy to this Ex-Cell-O Cam-Operated Precision Boring Machine. Direct cam action makes it possible. Two cams are mounted on a single shaft; one acts directly on the cross slide follower, the other on the table follower. There are no levers. Changing the cams changes the form for the next job—in minutes.

Style 308 (illustrated) and the larger Style 312 hold the parts in one or more spindles, tools are mounted on the cross slide. The machine above uses such a setup to straight-bore and generate the inside contour of 184 parts per hour, two at a time.

If you are anxious to get a similar production process underway quickly and economically, start now by calling your local Ex-Cell-O Representative. Or, if you prefer, write direct.

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EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

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TRENDS

MACHINE TOOLS...

Government to study problems...

A federal government interagency committee is to study the problems facing the machine tool industry and make a report within 60 to 90 days to L A Hoegh, Director of the Office of Civil and Defense Mobilization, according to Washington reports.

The committee consists of representatives of OCDM, Defense, Treasury, Commerce, and State Departments. It is taking on this assignment at Mr Hoegh's request following a meeting on October 29 between OCDM and top officials of National Machine Tool Builders' Association.

A letter to OCDM...

The October 29 meeting was the aftermath of a 26-page letter sent to Mr Hoegh in August by Ralph J Kraut, NMTBA president, setting forth the principal machine tool problems facing the government and the machine tool industry.

The letter is reported to have discussed the trend toward increased imports, the decline of the export market, establishment of facilities abroad by U S machine tool builders, the effects of unrealistic tax depreciation policy, and failure of the Defense Department's machine tool replacement program to get going.

Industry representatives made clean the fact that they have come to no conclusion on the advisability of seeking import restrictions under Section 8 of the Trade Agreements Act. Mr Kraut's letter, which sets forth the industry's thought, is reported to take the position that only the government can evolve solutions to the industry's problems in terms of the security of the nation.

The letter is understood to point out that unless some of the recommendations of the machine tool industry are adopted (such as more rapid depreciation), the industry's capacity will continue to shrink and U S industry and the national defense will be increasingly dependent upon the economies of foreign nations.

Mr Hoegh considers the machine tool industry essential to the nation in peacetime as well as in wartime, well informed sources say.

Meeting European competition...

More and more U S machine tool builders are beginning to supply their Canadian customers from their British or Continental European plants. They say that only in this way can they meet successfully price competition from European builders.

This is not a sudden development. It has long been in the making. It actually began 12 to 24 months ago, or perhaps longer. At present, competition in Canada has become so keen that U S builders who held off from shipping from Europe are now doing so.

The current trend toward making American machine tools in Europe for installation in Canada is expected to grow rather than diminish.

US-foreign firms negotiate...

Negotiations go merrily along between U S builders and European companies for manufacture of U S machines abroad. One Midwest builder hopes by the end of the year to complete licensing arrangements to have his machines made in both England and Germany, inside and outside the Common Market.

Another builder has been looking into the possibility of having his machines made in Japan and perhaps of importing Japanese-produced components to be assembled into his U S machines.

Several builders are known to be considering importation of component parts from European plants for their machines built here at home. Reason: low cost stemming from low labor rates.

To stay out of Europe...

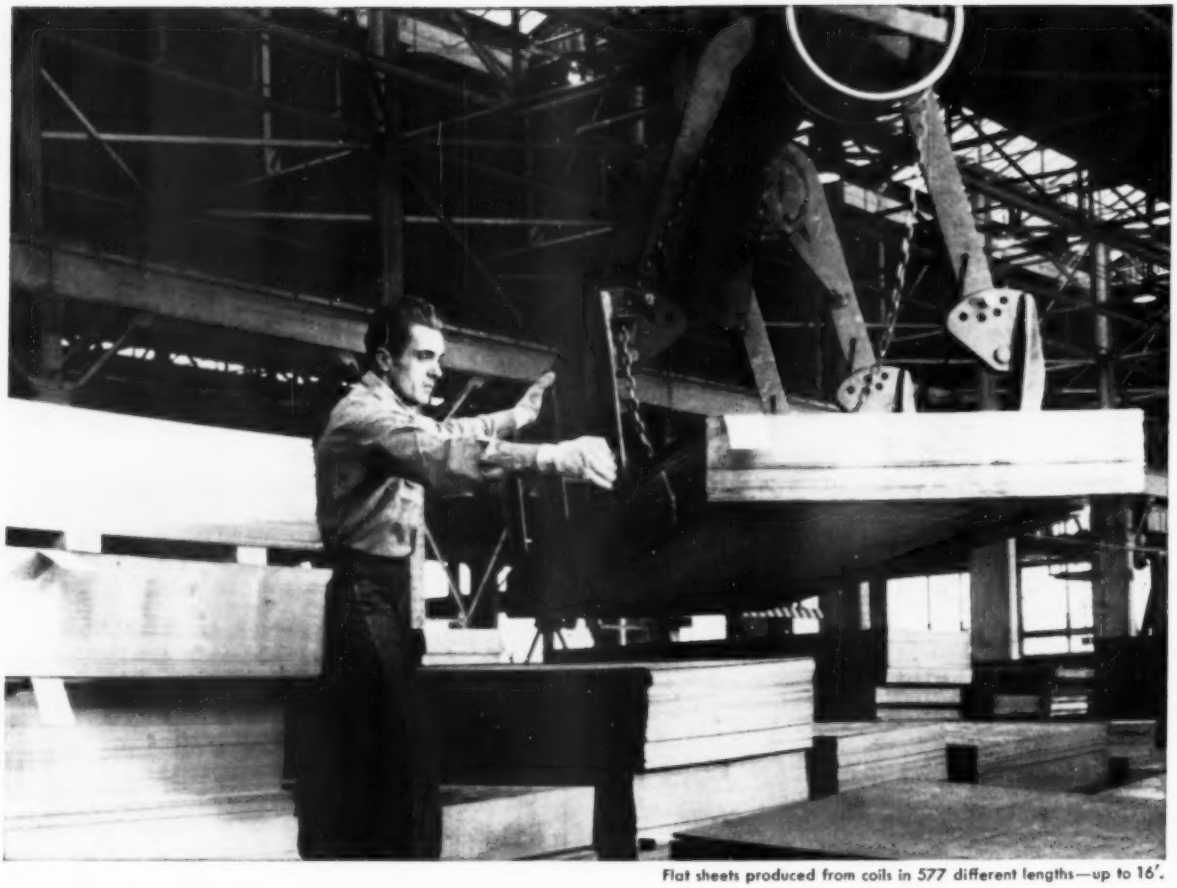
At variance with the strong trend toward establishment of European facilities by U S builders is the decision of several makers of transfer and other special machines not to license any European companies or to acquire manufacturing plants abroad.

These builders feel that they cannot compete successfully with the fast-improving European builders of special machines on the latter's home grounds. Unless a U S builder can offer a production technique or a new development not available over there, European users tend to buy from European builders.

U S builders of special machines who advocate staying out of Europe stress that their problems are far different from those of companies making general purpose tools. They feel that they are selling, among other things, highly specialized knowledge which is difficult if not impossible to license.

Ex-Cell-O of India formed...

Ex-Cell-O Corp, Detroit, has formed a new company, Ex-Cell-O of India, for the purpose of building machine tools in India and of manufacturing miscellaneous production parts on a subcontract basis for Indian firms.



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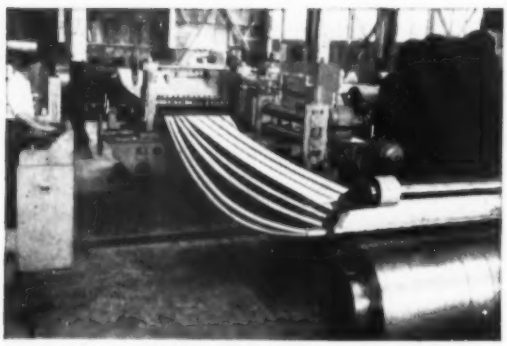
with Ryerson quality-controlled steel



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MATERIALS...

Fuel-cell power...

Fuel cells are essentially batteries, consisting of electrodes and electrolyte, but with one big difference: Conventional batteries, or cells, have their energy stored in the electrode-electrolyte system within the cell, whereas the fuel cell can store no energy within the cell itself. It instantaneously converts chemical energy to electrical energy.

A fuel (such as hydrogen) oxidized in the cell, gives up electrons which provide the power. In theory, a fuel cell can supply electric power as long as the fuel supply lasts. Several types of fuel cells are being investigated. Among these are direct fuel cells using solid fuel, semi-direct cells which use gaseous fuels and indirect cells using an oxidation-reduction (Redox) system.

There is no theoretical limitation on efficiency when the free energy of the chemical reaction is converted directly into electric energy. The possibility of producing electric power directly from a fuel at an efficiency of 90% offers tremendous potential when compared with the best diesel engines, which are about 40% efficient. Because the fuel cell does not involve heat but converts chemical energy directly into electric energy, it escapes the high heat-engine energy losses.

Engineers see in the fuel cell a valuable energy conversion method. Off-peak generator facilities could produce hydrogen and oxygen which can be stored, transported and used as needed in fuel cells. Low-voltage constant loads of such electrochemical processes as plating, water purification, galvanizing, electrolytic cleaning and electrolytic refining of metals could use this source of direct-current power.

How much power will it offer? Because there is no need to store electrolyte, the fuel cell will produce more power in less space than conventional cells. Allis-Chalmers demonstrated its fuel cell, operating on a mixture of gases (largely propane) by installing it and a 20-hp dc motor in a 5270-lb tractor. A total electrical output of 15 kilowatts was supplied at one volt open circuit by 1008 cells, each one-quarter-inch thick by 12-in. square. Tractive power was 3000 lbs at the drawbar on a dynamometer.

Aluminum-strip conductor...

Sparton Automotive division of Sparton Corp has switched from copper and aluminum magnet-wire coils to interleaved aluminum-strip conductor coil units for use in more than a million horns. Reynolds Metals Co claims this use as the first large-scale application of aluminum foil strip conductor in a volume production coil.

Aluminum foil offers better heat transfer and dissipation, hence less danger of burnout, all in less space, according to Dr Weichien Chow, chief development engineer at Sparton Automotive. In addition, the company was able to eliminate 12 parts from its old model horn for a compact, more efficient unit.

Bendix acquires mag license...

Bendix Aviation Corp has acquired a magnesium alloys patents license from Magnesium Elektron Ltd, Manchester, England. The license grants Bendix the right to manufacture, use and sell in the U S castings produced by Magnesium Elektron's techniques. The metal alloys are used in such applications as castings for jet-engine compressors, jet-engine expansion chambers and gear boxes, and high-pressure hydraulic equipment for missiles and other high-performance aircraft.

Included under the license are the rights to the "Elekton" alloys of the zirconium, rare earth, and thorium series, known as Alloys Z5Z, ZRE1, RZ5, ZT1 and ZT6. Also included is the new magnesium-silver-rare earth alloy MSR, said to be the strongest magnesium alloy developed to date.

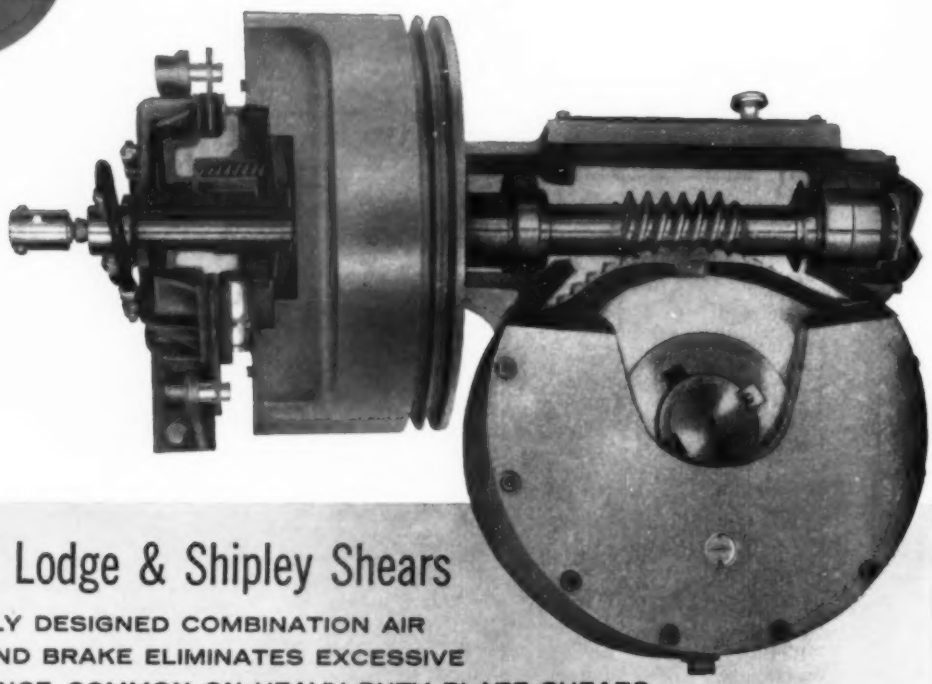
New bolt standard...

A proposed new series of hexagon-head bolts would establish a high-strength structural bolt with a wider head, to provide enough bearing area so that no washer would be needed. While a heavy hexagon-head bolt could be used, the extra head height would add unnecessarily to the cost.

Chloride chemistry...

Chloride derivatives of lower-valent transition metals are Union Carbide Metals' latest contribution to chloride chemistry. In experimental quantities, subchlorides of columbium, chromium, titanium, vanadium, tungsten and zirconium have been produced. Some of these have not been produced before. The subchlorides are potentially applicable as catalysts, metal-plating compounds, reductants in organic syntheses, and as intermediate products for new organometallics. With 100 million pounds of polypropylene predicted for 1960 production, Union Carbide Metals' titanium trichloride will reach commercial status as a polymerization catalyst.

EXTRAS on the machine . . . not on the invoice!



Only on Lodge & Shipley Shears

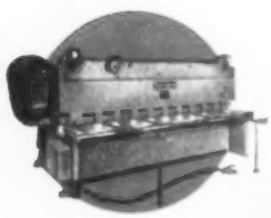
...SPECIALLY DESIGNED COMBINATION AIR CLUTCH AND BRAKE ELIMINATES EXCESSIVE MAINTENANCE COMMON ON HEAVY DUTY PLATE SHEARS

The "standard extras" you find on Lodge & Shipley Shears, although not reflected in the price, are important in time-saving, effortless operation, accuracy and low-cost service.

THE COMBINATION AIR CLUTCH AND BRAKE, for example . . . its single unit design positively eliminates overlap between clutch and brake. Disc-type construction is self-adjusting for fast, smooth starting and safe, positive stopping. The clutch provides automatic overload safety; the brake applies automatically in the event of electrical or air supply failure.

NO OTHER SHEAR, EVEN AT EXTRA COST, can offer the exclusive combination of features found, for instance, on the ½" Lodge & Shipley Shear:

- 2-stage Hydraulic Holddown System
- Remote-operating Foot Control • Ball Transfer Table
- Motorized Front-Operated Back Gauge
- One-piece Shaft with Integral Eccentrics
- Blade Clearance Indicators • Air Counterbalances
- Air-cushioned Back Gauge • Blade Changing Jigs
- Fast, One-man Upper Blade Adjustment
- Independent Holddown Fingers • Quad-life Worm Gear



Capacities to ½" x 12'

Find out how much more you get . . . **WITHOUT EXTRA COST** . . . on a Lodge & Shipley Shear. For details, see Sweet's Machine Tool File or request Bulletin No. PS-15 from: The Lodge & Shipley Co., **3056** Colerain Ave., Cincinnati 25, Ohio.

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WHAT'S AHEAD... in Metalworking

A time without parallel...

Never before in history has American metalworking been faced with a situation even remotely similar to that which confronts it today. Steel shortages, caused by the longest steel strike of all time, have hogtied industry just at a time when it was gathering momentum and headed for new peacetime production peaks.

Result is that there is no historical background upon which to base guesses as to when and how industry will get back into peak production.

But it is a foregone conclusion that it will take many months to get industry back onto the road to the top. Hardest hit have been the mass-production industries, such as autos and appliances, which need tremendous amounts of steel to keep production going. But now, steel shortages have reached such epidemic proportions that even those metalworking industries which make small runs of specialized products are suffering.

Take, for instance, steel foundries, which have just begun to be affected by shortages. Pre-strike bookings had reached 70% of maximum demand. Today, they are at 50% and dropping.

Screw machine products manufacturers, who were heading for a banner year, now aren't even sure that they will equal pre-recession 1957 business.

Heat treaters are just beginning to feel the pinch. Pre-strike boom in orders is beginning to taper off rapidly as customer plants cut back output. Here again, this industry would have had a really good year if it weren't for the steel strike.

Metalworking job shops are beginning layoffs, now that they have traded and bartered steel as long as they could.

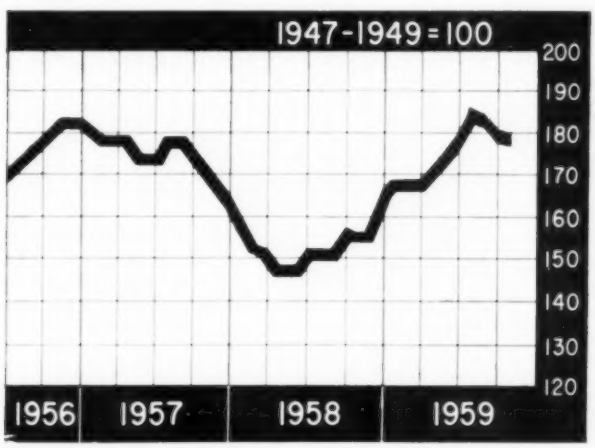
There is still some steel around, however, much of it at a price. A few consumer industries, mostly in the Midwest, are managing to keep going by buying gray market steel at two to three times the normal price. Others are getting steel in from Canada, still others from small steel mills unaffected by the strike. But there still seems to be an aversion to buying foreign steel —either as a matter of ethics or because orders placed now with steel importers very possibly couldn't be filled until well after shortages end.

Latest reported gray market prices: anywhere from 16¢ to 25¢ a pound for 16-gage hot-rolled sheet: flat steel at 15¢ to 19¢ a pound.

Even so, there is little gray market steel around. Automakers are reportedly making "ridiculous" offers to lure steel out of hiding, but without much success. For one thing, conditions just aren't right for development of a gray market, which depends on *some* production of steel.

In such cases, a manufacturer who has more than enough for his immediate needs may be tempted to sell his surplus to a broker for a profit. Then the broker resells it at another profit. This time, sources are too dried up—a manufacturer who can get steel will make a lot more profit by making something out of it.

The automotive industry, for instance, would be working full tilt right now filling dealer pipelines on 1960 models—and it is especially unfortunate that the long-heralded U S compact cars are making their debut at a time when it is almost impossible to get steel to make them.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

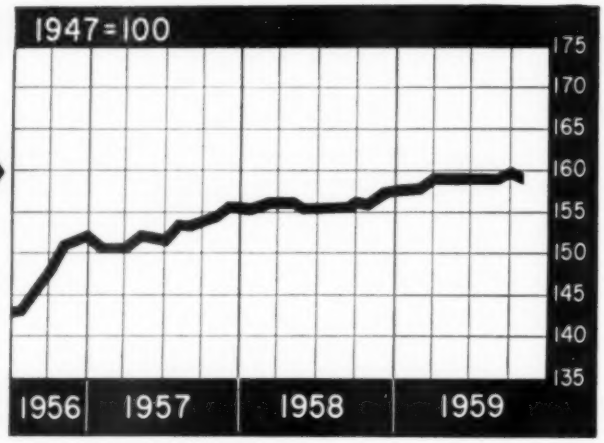
	OCT. Estimated	SEPT. Preliminary	AUG. Revised	SEPT. Year Ago
Total Index	**180**	**183**	**183**	**156**
Machinery	157	159	159	130
Electrical Machinery	227	221	221	185
Autos	131	133	133	66
Other Transportation	346	350	350	374
Other Metalworking	154	156	156	141

TRENDS

WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	OCT. Estimated	SEPT. Preliminary	AUG. Revised	SEPT. Year Ago
Total Index	**159.8**	**159.6**	**159.4**	**155.8**
Metalworking Machinery	188.3	187.8		180.8
Other Machinery exc. Electrical	171.5	171.3		165.9
Electrical Machinery	162.2	162.2		158.8
Fabricated Metal Products	148.6	148.5		133.1



Export outlook brightening...

Exports of U S goods increased substantially in September. Total exports for the first nine months of the year lag behind last year's level, but the latest increase marks the fourth consecutive month in which exports of non-military goods passed year-ago levels. So the export picture is brightening.

Exports of goods and services are actually a small part of total U S output—less than 5%. But to some companies, overseas markets are an important sales outlet. And the performance of U S goods in foreign markets is a rough gage of how costs and salesmanship of U S producers stack up against those of overseas competitors.

Restrictions on imports of U S goods still tilt the scales against U S products in many areas. But every major trading nation has taken giant steps toward removing such restrictions in recent months. Japan recently vowed to do away completely with restrictions on U S goods.

Elimination of restrictions ultimately can mean an additional $500 million of U S exports. Recent policy changes requiring underdeveloped countries to spend U S funds for American products will also give exports a slight lift. Rising incomes and growing production abroad will be more important in expanding the U S export market.

Crumbling trade barriers won't however, mean an end to foreign competition. Industrial capacity of foreign producers has grown tremendously since the end of the war. Plant and equipment in use is in many cases more modern than capital equipment used by competing U S producers. And foreign products are being well received in the U S and other markets.

Steady improvement of plant and equipment to keep costs down in one approach to boosting export sales. A steady flow of new and better products coming out of stepped up research and development activities is another.

WEEKLY BUSINESS INDICATORS	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49=100)	141.0	142.5	137.1
Steel ingot operation (thousands of tons)	368	371	2,011
Electric power output (million Kilowatt hours)	NA	12,762	12,330
Production of automobiles and trucks	103,013	112,488	97,804
Engineering construction awards (Eng. News-Record, millions)	$251.9	$318.5	$221.5

MONTHLY BUSINESS INDICATORS	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	148	149	137
Index of durable manufactures production (1947-1949=100)*	158	159	145
Durable goods manufacturers' sales, millions*	$13,975	$15,384	$12,385
Machinery manufacturers' sales, millions*	$ 4,671	$ 4,778	$ 3,817
Durable good manufacturers' new orders, millions	$14,005	$15,493	$12,177
Machinery manufacturers' new orders, millions	$ 4,637	$ 4,893	$ 3,851
New Orders for Nonelectrical Machinery (1950=100)*	181.7	159.1	161.0
New Contracts for Industrial Construction (1950=100)*	170.7	164.9	76.2

* Seasonally adjusted

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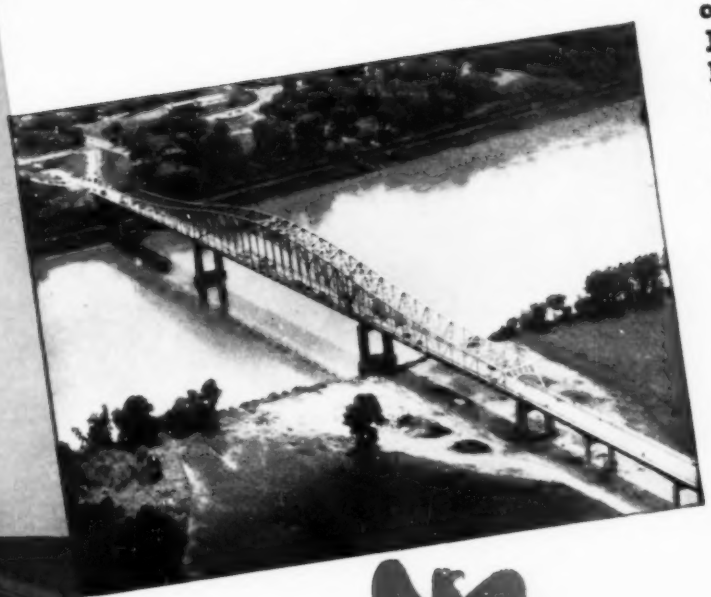
THE THOUSANDS OF HOLES

required in the construction of the recently completed Jefferson City, Missouri bridge by Stupp Bros. Bridge and Iron Company, of St. Louis, Missouri, were all drilled by "AMERICAN" Hole Wizard Radials.



One of the oldest and largest bridge builders and steel fabricators of the Middle West, Stupp Bros. use "AMERICAN" radials exclusively for their drilling operations. Their main reason for using "AMERICAN" exclusively is LOW COST PER HOLE.

Quick Handling—Fast Penetration—Low Maintenance are the prominent contributing factors.

"AMERICAN" Radials can be relied upon to pay excellent returns upon the user's investment.

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THE MAGAZINE OF METALWORKING MANUFACTURING • ESTABLISHED 1877

That's What We Like About '60

Nineteen sixty looks like a whopping good year for the metalworking industry.

The longest steel strike in history has had a chilling effect on metalworking production lately. The 1959 total will suffer as a result. But the prolonged inability of users to secure steel will make next year even better than it might otherwise have been.

Take automobiles...

Detroit finally has yielded to public demand for smaller cars. Brand-new designs are being offered for the first time in years. The effect is electrifying.

The year ahead looks good for domestic shipment of six-and-a-half to seven million passenger cars. At least one million trucks will be built too. So the next calendar year may well chalk up output of seven-and-a-half to eight million cars and trucks.

Capital spending for new plant and equipment promises an upsurge in 1960 that will carry it to heights where it has not been for several years. A just-completed checkup by the McGraw-Hill Department of Economics reveals a contemplated outlay of $3.8 billion by the metalworking industry alone.

That is a healthy gain...

of 15% over capital spending outlays this year, during which the total has suffered from the steel strike. Spending next year will make up for this year. It will forge ahead in virtually all major segments of Metalworking — industrial machinery, electrical machinery, automobiles, and other transportation equipment.

The automobile industry in particular plans to install new plant and equipment costing $841 million, an increase of 30% over 1959. The most encouraging aspect of this news is that Detroit will no longer be acting like a poor cousin when it comes to capital spending.

Capital goods producers, as a result of higher investments by customers in cost-cutting machinery and in tooling for new products, will operate next year at a better level than in several years. Even with all the attempts to keep the federal budget within manageable limits, defense production will stay right up where it has been. It will continue to be a stabilizing factor.

There is no significant area in Metalworking in which the outlook is not bright. It is a safe guess that metalworking production in 1960 will set an all-time record in physical output of goods and in dollar volume of shipments.

This is an exhilarating prospect...

But it should not be cause for any manufacturer to be lulled into complacency. No matter how big 1960 may be, it is not going to be a simple matter dividing up the goodies evenly among everybody.

Next year, as in any year, the companies with superior products priced at reasonable levels that customers are willing to pay will get a major share of the business. And unless a manufacturer can make his products at a reasonable cost in relation to his selling price, he will find himself in or on the edge of a period of profitless prosperity.

As we head into a year that holds tremendous promise for Metalworking, there is still time for you to examine how fit your plant is to turn in a good record in 1960. It is never too late to slash your costs. Be sure that in the bulging year ahead you do more than trade dollars.

Burnham Finney EDITOR

1150% Increase in Production of Fastener Assemblies with *KENCO Electro-Safe Press*

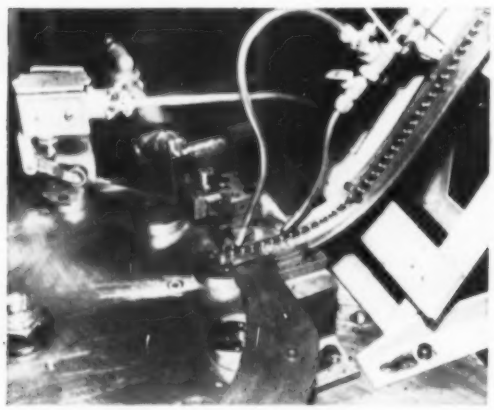
Kenco 8 ton Electro-Safe Press equipped with 12 Station dial feed assembles two components automatically to produce 2500 Floating Press Nuts (inset) per hour.

Electro-Safe Press Controls Provide Fail-Safe Features Needed for Fault-Free Automatic Operation

Rosan, Inc. of Newport Beach, California increased the production of Floating Press Nuts from 200 to 2500 per hour by converting from a hand fed operation to a completely automatic setup. The new setup employs an 8 ton Kenco Electro-Safe Press equipped with a 12 Station Dial Feed. Hoppers at Stations 1 and 3 automatically feed the two parts to be assembled under the press punch at Station 7. The completed Floating Press Nut assembly is automatically ejected at Station 8.

In designing the hopper feed mechanisms, Rosan had the problem of joining two components which had to be nested in exact orientation to permit proper assembly under the press punch. In addition there were 10 different sizes which the installation must accommodate. An Electro-Safe press was selected for the job because its controls and drive are specifically designed to permit simple interlocking of checking devices which monitor proper function of critical points in automatic operation. In event of misfeeding or malfunction, an Electro-Safe Press stops instantly before damage occurs.

Kenco Electro-Safe Presses are furnished from 8 to 25 tons and will enable you to employ modern tooling concepts with greater safety. This means that it costs less to run a given lot of parts with Electro-Safe's unique control features.



Feed track leading from hopper to nest at Station 1. Air actuated Feed Finger provides timed escapement of parts when nest is in loading position. Should part not properly enter nest, the feed finger will not reach its limit of travel and will instantly stop Electro-Safe Press. Also shown is limit switch check point at Station 11 which assures each nest is empty after the ejection at Station 8.

Job Facts

Location—Rosan, Inc., Newport Beach, California

Equipment—Kenco 8 ton Electro-Safe Press with 12 station Dial Feed. 2" press stroke at 50 st. per m. Tooling Designed by Rosan.

Production—Former rate: 200 pcs/hr. Present rate: 2500 pcs/hr. Percent increase: 1150%.

Sequence of Operations by Stations—1. Feed retainer by hopper. 2. Idle. 3. Feed captive nut by hopper. 4. Idle. 5. Counter. 6. Idle. 7. Close in retainer under press punch. 8. Eject assembled Floating Press Nut. 9. Idle. 10. Idle. 11. Safety Check stops press if Ejection malfunctions. 12. Idle.

Free Press Tonnage Calculator — Write Kenco for this convenient aid. Easy to use and in a few seconds gives required press tonnage according to size of stamping and material being used. Complete with full instructions.

2 Ton · 5 Ton · 8 Ton · 15 Ton Deep Throat · Electro-Safe · Slow Speeds · Mark Series

also 18, 21 and 26 tons capacities

THE MOST COMPLETE LINE OF SMALL PUNCH PRESSES IN THE WORLD

KENCO
Manufacturing Co.
3211 Telegraph Road, Los Angeles 22, California
ANgelus 1-9503

THIS is the Cadillac-like ZIL-III, proudest achievement of Russia's auto industry . . .

BUT the ZIL-III is for use of party higher ups and visiting VIP's (even Khrushchev doesn't own the car he rides in). Russia's Man in the Street is extremely lucky to get a motor scooter

RED AUTOS

—an Iron Curtain separates production and demand

Tourists returning from Moscow say they have heard rumors that the Central Committee of the Communist Party toyed with the idea of putting a stop to public sale of automobiles in Russia, then dropped the scheme because of its possible detrimental effect on Soviet public morale.

But the idea was a purely academic one anyway—Russia's Man in the Street, even if he has enough rubles to pay black market prices, has to wait years before his name comes to the top of even illegal waiting lists for cars. Legally, it's an impossibility for any but top Soviet officials, industrial management men or celebrities to get a made-in-Russia automobile.

The truth is that Russian demand for cars is voracious but production is piddling. In the Soviet Union, the motor car is destined to be a "class item" for many years to come. Of the 120,000 automobiles expected to roll off the line this year, 80% will go to official use, to government and party higher-ups or for taxi service . . . and there are no great production expansion plans in sight.

The other 20% of Soviet automobile production is consigned for export "just to get Soviet cars in front

American Machinist

WORLD INDUSTRY

Automotive Report No. 3

Russia makes BIG CARS . . .
Chaika (Seagull) is comparable to a U S medium-sized auto, develops 195 hp

LITTLE CARS . . .
This is one of Russia's new 4-passenger MZMA-965 "midgets"

ODD CARS, TOO . . .
To get into this bubble-car you open the windshield, climb through

BUT Russia's economy is still geared to war production and to a drive for industrial supremacy. That's why passenger cars take a back seat to giant heavy-duty trucks like this one

of the world eye." In line with this, scores of taxis have been drafted into the Intourist fleet to give foreign visitors an impression of ample auto transport.

Russia's new Seven-Year-Plan, so highly lauded by Khrushchev on his recent visit to the United States, makes little provision for an increase in automotive production. Last year combined production of trucks and cars rose slightly to 511,000 units, of which roughly 23% were autos. By 1965's end, total car and truck production is scheduled to hit only a level of somewhere between 750,000 and 856,000 vehicles, of which 68,500 units will be automobiles.

Considering that Russia has more than 200-million people, the number of persons per car in that country is fantastic, compared with the United States' one car for every three people, even Italy's one car for 25 people.

Even so, the Russians don't resent their government's exporting of 20% of all cars. Rather, they consider overseas sales as a national accomplishment, point with pride to the 200,000 Russian cars and trucks on the streets and roads of 42 foreign countries.

Principal buyer nations for Soviet cars, aside from the Communist Bloc countries, are Finland (which reportedly has 30,000 Soviet passenger cars), Norway, Iceland, Egypt, Afghanistan, Iran and Burma. And under its five-year trade agreement

with Great Britain, Russia hopes to have Soviet cars in U K showrooms for the first time within the next few months.

Today, most of Russia's automobiles are turned out in Moscow and Gorki, but there are plants in several other cities.

Russian - produced automobiles range in size from the Cadillac-like ZIL-III, a seven-passenger, eight-cylinder, 220-hp sedan shown at the recent Soviet Exhibition in New York, down to a new four-seater midget car with an air-cooled 23-hp engine. In between are the Buick-sized Chaika, the Rambler-sized Volga, and the compact-car-sized Moskvitch 407.

Detroit-style innovations and luxury accessories are almost entirely confined to the huge ZIL-III, which has a pushbutton-controlled automatic transmission, power steering and power brakes, a window-glass washing device, tubeless tires, front-and-rear radios, power windows and in a few instances, air conditioning.

A car like the ZIL-III is not only a rarity in Russia itself but in other Communist Bloc nations, which prefer to concentrate their production on small cars of less than 45.76 cu-in. displacement.

About 117,000 such cars will be produced annually by Czechoslovakia by the end of the current Seven-Year Plan (1965-66), while Poland plans to manufacture 100,000 a year by then.

Russia itself will shortly start production of the 45.76 cu-in. Bjelka, which will come in two versions—one for good roads and town traffic, the other for bad roads and country driving. The former will be a 4-passenger job, the latter a 2-passenger-and-freight model.

Satellites: big ideas, little output

East Germany recently started production of the Trabant, with 30.51 cu-in. piston displacement. The Trabant, with its limited engine power, its limited top speed, and its austere finish is in line with Communist countries' concept of automotive design—a car that uses little steel, has low fuel consumption, as little chrome and frills as possible, but which still provides basic transportation.

Of the auto-producing nations within the Soviet Bloc, Czechoslovakia is the oldest and most-experienced, having been in business long before the Communists took over after World War II. In fact, when the Communist-government ordered nationalization and reorganization of the Czech auto industry, it set design and production back so far that the country's automotive industry is only just now getting on its feet again.

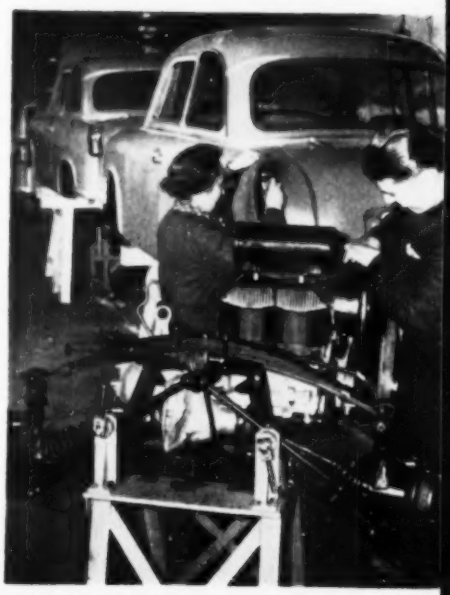
Last year, the Czechs built 44,000 cars. This year they will make 52,000 cars, 99.5% of which will be of the small Skoda make, and the other 0.5% Tatra luxury cars. In the works, too, is a small two-seater car powered by a motorcycle engine. Designed primarily for invalids, the Velorex weighs only 803 lbs, develops only 22 hp.

The Czechs evidently prefer to swim against the tide of worldwide automotive trends. Long a major producer of motorcycles, Czechoslovakia refuses to recognize the buying trend that exists in Europe today—first a motorbike, then a used car, and finally a new one. Perhaps it's because production of the latter is so inadequate that Czechs can't even aspire to ownership of a car, new or used, that the country prefers to concentrate on production of motorcycles, for which it has a worldwide reputation.

And because the shortage of automobiles is so acute, the Czechs also plan to concentrate on production of common carriers such as trucks and buses. These are all made either at Skoda's Plzen factory or at Praga, near Prague. All passenger cars (Skoda and Tatra) are produced at the Tatra plant.

As in Russia, demand for automobiles far exceeds production, which

East Germany is no rival to West Germany—Europe's No. 1 auto producer



Primitive stationary production line . . .
for East Germany's plastic-bodied Trabant (18 hp) contrasts strongly with the ultra-modern automated methods of Volkswagen and other West German automobile manufacturers

CZECHOSLOVAKIA's auto industry is oldest of any Eastern Bloc nations' . . .

Small cars like these Spartaks . . .
comprise 99.5% of Czech auto production (the other 0.5% is Tatra luxury cars). Actually, the Czechs prefer to make motorcycles, for which they have a worldwide reputation

Red China is coming up fast . . .
. . . could one day be a real factor in Far East markets because of its cheap labor rates. Here, China proudly displays its new makes in a parade of progress held last year

is largely governed by availability of steel and other materials. Such exports as are effected are done so for propaganda purposes. Imports from other Iron Curtain countries, as well as from France, Italy, Britain and West Germany, are growing. It is the opinion of exports that Czechoslovakia cannot begin to make a dent in the world automotive market for three to five years.

Polish production is expected to increase eightfold in the next 10 years. That statement on the surface is impressive. It's a lot less so when you know that output today is slightly over the 15,000-cars-a-year mark, and that there are only 90,200 cars on the roads in all Poland. In fact, there are almost as many trucks in Poland as there are passenger cars.

Poland's 1959 production plans include 14,000 Warzawa M-21-D cars and 1000 Syrenas, both of which are built at Zrean. Along with this goes output of 5000 motor scooters, 10,000 MoPeds and 8000 motorcycles.

The great change in Polish car design and production won't come until 1962, when the current Warzawa M-21-D, a version of the Soviet Volga, will be replaced by an Italian-designed car.

Polish production plans for the next five years show an increase in small cars. While output of the Warzawa will increase to 31,000 units by 1962, production of its Italian-designed (Ghia) successor will be only about 10,000 units a year. However, production of the smaller Syrena will increase from 1000 units a year to 10,000 units by 1962.

Polish truck production totaled somewhere around 20,000 units this year, plays a large part in that country's Seven-Year Plan, which calls for a gradual increase in the number of units per year to 122,000 by 1970.

Hungary occupies a peculiar position in the Communist automotive manufacturing setup — producing trucks, buses, motorcycles and motor scooters, but no automobiles. All cars used in the country are imported from the West or East European countries.

Last year, Hungary produced 3683 trucks, 1414 buses, and 55,800 motorcycles—not very impressive totals, but they mark a tremendous increase in just a few years.

Next year, Hungary will have produced its 90,000th engine, its 45,000th truck, its 12,000th bus. Of these, 20,000 trucks and 9000 buses will have been exported, entirely for political purpose: they are badly needed at home.

Rumania can hardly be considered one of the brighter stars in the Soviet industrial firmament. Slavishly dependent upon the Soviet Union for designs, blueprints and most materials, Rumania has two truck plants and two tractor plants.

In the entire period from 1953 to 1957, Rumania turned out only 13,000 trucks. In 1958 it produced 5334, this year 8000. Its plans for 1958 through 1960 call for output of 30,000 trucks —a goal experts believe stands little chance of attainment.

But this is certainly not true of Communist China, which last year turned out its first successful-by-world standards automobile, now has at least four makes in production. Starting from absolute industrial scratch, the Chinese have come up so fast in so short a time that they are today a source of worry rather than of pride to their Soviet overlords.

Communist Chinese auto production has been characterized as "red and expert." There is, for example, a 55-hp prototype sedan turned out by students of Tientsin University. The four-cylinder car, which attains a top speed of about 67 mph, is Detroit-like in its styling, even to double headlights. Called "Peace," the car seats five passengers, comes with radio, heater and an air-cooling system. It is China's newest.

The first of China's cars, the Hongchi, produced by the Nol Motor Vehicle plant in Changchun last year, took only one month to design, according to the Chinese.

The six-passenger sedan can do 111 mph, has a wraparound windshield, power doors, air-conditioning, 8-cylinder engine that attains 200 hp.

Another of Red China's new cars is the Phoenix, made in Shanghai. Called by the Chinese a "high-grade sedan," this standard-sized car nevertheless attains only 72 mph.

The Chinese also make a jeep, presumably without even a thank you to Willys. By July, 300 of these had been produced.

Little threat to the West

So far, the Communist Bloc countries have showed precious little ingenuity in designing their own cars, a lot of ingenuity in stealing ideas wholesale from the West.

This lack of engineering initiative, along with lack of adequate mass production facilities and methods in most Communist Bloc countries, should keep Russia and her satellites from becoming a serious threat in world automotive markets for many years to come. Even though those countries might seek a foothold in the West, in South America and the underdeveloped countries by undercutting Western prices (as they have done with capital machinery in Mexico for instance), lack of automotive production ability and facilities as we know them in Detroit will keep auto output one of the lesser factors in Russia's vaunted new Seven-Year Plan.

Highlights of 1959's Metal Congress & Show...

Explosive forming plays to SRO

"Standing Room Only" signs were up as a seminar on explosive forming and hardening drew an overflow crowd of 500 during the week-long National Metal Congress & Show in Chicago early this month.

The seminar, one of several that highlighted American Society for Metals' technical program, took on added significance when a show of hands indicated that more than a third of the audience were either working with explosive processes or planning to soon.

Speakers and panel members included DuPont's C P Williams, John J Kelly of Stanford Research Institute, C O Williams of Olin Mathieson Chemical Corp, Floyd Cox of Ryan Aeronautical, Joseph L Bird of Introform Inc, John Rinchart of Colorado School of Mines, and John Pearson of China Lake Naval Ordnance test station. During the course of the seminar, a variety of unusual test parts was shown.

One speaker pointed out (as has been said of nuclear bombs) that pressure created by a high explosive increases with quantity only as the cube root. Thus, eight pounds of explosive produce only twice as much pressure as two pounds. On this basis, people needn't worry quite as much about using excess explosive.

On the other hand, pressure moving out from the point of explosion is inversely proportional to the distance. This condition makes the distance between the explosion and the work much more critical than the amount of explosive used.

Understanding which explosive to use is extremely important for successful forming and hardening. Basically, there are two types: low-pressure explosives (better known as propellants) such as black powder, and high-pressure explosives such as RDX. With the propellants, the rate of burning increases as the pressure builds up.

These variables make propellants, which produce only about 60,000 psi of pressure, more difficult to use. High explosives, on the other hand, produce about 2-million psi pressure in one- to five-millionths of a second and the pressure is reasonably constant.

Hardening by explosive energy occurs in one of, or a combination of, three ways: twinning, martensitic transformation, and a more mysterious, slighter, hardening which occurs at the lower pressures and shows no structural effect. The latter can be seen only as a slightly heavier background in diffraction patterns. Speculation has it that the hardening might be a form of cold working.

When a question regarding spark bombs, magnetic impulse and Dynapak was asked from the audience, none of the panelists would volunteer to answer it. Obviously, high-energy techniques are taking two roads.

Sheet explosive

DuPont exhibited its new sheet explosive, EL-506A, which is basically PETN (pentaerythritol tetranitrate), plus ingredients that make it flexible. It is waterproof, highly resistant to impact, is fixed with a blasting cap. The sheet will conform to practically any shape. Used for a variety of forming operations, the primary roll of EL-506A right now is in hardening austenitic manganese (Hadfield's) steel.

Displayed at the seminar were a wide range of explosively formed parts, including a large engine housing, dies for electrical discharge machining, auto trim strip, bottle molds, etc. One shim-thick stainless steel gasket containing many holes of different diameters was produced by a single female die in one shot.

Cold working steel

At another ASM technical session, beneficial effects of cold working on temper brittleness of some steels were cited by U S Steel's A S Keh and W C Porr:

- Cold working after quenching and tempering reduces susceptibility to temper brittleness. The more severe the reduction, the less susceptible steel is to subsequent embrittlement.
- An embrittled steel can be made tougher by cold working and reannealing in the embrittling range.
- Change of tensile properties because of cold work and embrittlement can be qualitatively correlated with impact behavior.
- Solute segregation, grain boundary segregation, and perhaps subsequent precipitation of solute atoms are believed to lower the intergranular strength of steel and cause brittleness.

Ten countries compete for US

Again this year, a large number of foreign machines and metalworking products were in evidence at the Metal Show, held early in November at Chicago's International Amphitheater. Products of Canada and eight foreign countries vied for customer attention with those of the United States during the week-long Show. Among the important new products and processes shown by U S exhibitors were:

One of the largest beryllium parts yet produced, a 74-in. OD, 340-lb heat shield for Project Mercury, was shown by Brush Beryllium Co of Cleveland. Worth some $50,000, this accurately machined, dish-shaped part was press forged from a powder-metal blank in the 50,000-ton capacity hydraulic press at Aluminum Co of America's Cleveland plant prior to machining.

Columbium forging

Other unusual metal parts exhibited during the 41st Metal Show were one of the first "commercial" columbium forgings produced in this country, and a large 30-in.-dia, titanium-clad steel dished head shown by Union Carbide Metals Co. The Ladish Co used "Electromet" arc-melted columbium to forge the columbium 0.75% zirconium ring, which measures 8-in. OD, 6-in. ID, and ¾-in. thick. Most previous work in this field has been based on ultra-high purity metals.

A new electron beam welder said to assure top quality, precision welds in reactive, refractory and other high-performance metals was displayed by NRC Equipment Corp. This Model 2405 welder, priced at a fraction of the price of previously available welders of this type, makes possible fusion welding of items previously considered unweldable, including heat sensitive assemblies, dissimilar materials such as aluminum and steel, and even some nonconductors. Vacuum brazing, sintering, heat treating, and melting of small charges also can be done in a vacuum chamber.

Besides assuring contamination-free welds, the Model 2405 electron beam welder features an undisturbed beam path, with complete freedom from arcing, and with focal lengths controllable from 1 to 10 in. Spot diameter is controllable from 0.01 to 6 in. Penetration of ⅜ in. in stainless steel at 2.5 kw is claimed.

A "dry" phosphatizing process, introduced by Du Pont, eliminates water solutions and applies protective phosphate coatings to metal parts at considerable savings in equipment investment, floor space and operating costs. This process, which links trichlorethylene vapor degreasing to spray-in-vapor painting in a complete metal finishing system, was shown operating in a compact, plant-scale unit designed and fabricated by G S Blakeslee & Co, which is cooperating in the development of the process.

In the new dry phosphatizing process, metal parts are given a phosphate coating by dipping or spraying with a trichlorethylene-based phosphatizing solution maintained at its boiling point (188 F). As the parts emerge from the vapor zone, the solvent completely evaporates, leaving parts dry and ready for immediate painting. The coating, as formed on steel, is a strongly adherent form of iron phosphate, which provides an excellent paint base. Phosphate coatings can also be produced on other metals, such as aluminum, magnesium and zinc.

Additional savings can be achieved if a metal painting process using trichlorethylene as the sole thinner is added to the line to form a complete finishing system (the same solvent is used). This new process will be commercially available in mid-1960.

Another interesting new material introduced during the Metal Show is the "Skalix" coating announced by H A Storms, chief engineer of the Los Angeles division of North American Aviation Inc, and exhibited by Navan Products Inc, a North American subsidiary. This coating prevents scale formation on metal during heat treatment. Applications include stainless steel, nickel-chromium alloys, cobalt alloys, copper alloys, and the new exotic alloys now under development. Applied by dipping, spraying or brushing, the coating adheres to the metal at furnace temperatures, forming an oxygen-tight seal. As the metal cools, the coating pops off by itself. In many cases, no further processing is necessary.

Imported machine tools

"We must compete or die," Thomas F Patton, president of Republic Steel Corp, told a luncheon session of the American Society for Metals during the Metal Congress. US industry is losing its ability to compete with foreign producers despite enormous expenditures for improved efficiency, he warned his listeners.

"Our output per man hour is higher than that of foreign producers, our products are as good or better than theirs, yet they are beginning to outsell us in foreign markets and to make serious inroads in our own domestic markets," he said.

The gap is widening, he claimed, because US producers are being priced out of competition with foreign producers because of higher labor costs. He concluded by stating that there is no easy solution to this problem, but urged cooperation by union leaders and management executives to reduce the wage gap, intensify research and increase manufacturing efficiency.

Foreign exhibits

Ample evidence of the problem faced by US metalworkers was the low price tags on many of the large number of imported precision instruments and machine tools exhibited and offered for sale.

Sixteen Canadian manufacturers joined with Canada's Department of Trade and Commerce, Ottawa, to present evidence of their country's progress in metals and machinery fields during recent years. H J Horne, commercial counsel for Canada in Chicago, stated that some of these developments are so significant that they have been responsible for the introduction of entirely new production methods in Canada.

Of special interest were a ram-type turret milling machine, a lead-screw tapping unit and a "Versa-Belt" continuous coated abrasive belt grinder shown by Ex-Cell-O Corp of Canada Ltd, London, Ont.

The Ex-Cello-O style 602 ram turret milling machine has a 1-hp spindle drive which provides any desired speed from 90 to 2900 rpm, and an adjustable depth stop for power spindle feed. Ram has 16 in. travel, and the spindle head can be rotated 360 degrees. Table measures 9 x 36 in. and has 25-in. longitudinal travel, 12-in. cross travel.

Ex-Cell-O's Style 502 lead screw tapping unit can be used as a single spindle for holes up to approx 1-in. dia, or it can be used to drive multiple-spindle heads. It can be mount-

dollar at Metal Show

ed horizontally or vertically (with spindle nose down) or at any angle between these positions. Maximum feed stroke is 5 in. The spindle is designed to be driven with a 1½ hp, 1800 rpm motor.

Designed for use in place of the standard milling head on any conventional ram-type milling machine, a "Path-O-Mill" copy milling head exhibited by Pathex (Canada) Limited, Toronto, features a precision hydraulic tracing head and an actuating piston made as an integral part of the quill for the milling spindle. Spindle speeds are infinitely adjustable between 40 and 3000 rpm. The quill can be locked in any position.

Canadian hydraulic tracers

Several models of "Mimik" hydraulic trace units were shown by Retor Developments Inc of Galt, Ont. One was fitted to a large (25-x-25 in. table) automatic diesinking and contour milling machine designed and built by Williams Machines Limited, Preston, Ont. This machine is driven by a 20 hp hydraulic pump motor, has a stepless hydraulic copying feed from 0.010 to 60 in., and a spindle speed range from 41 to 3200 rpm. The Mimik "Dynatrace" with which the miller is equipped combines electronic and hydraulic controls to provide continuous path control regardless of angle or direction.

Fisher Gauge Works Ltd, Peterborough, Ont, demonstrated a Model 24 semi-automatic assembly die casting machine claimed to provide a fast means for assembly of precision components by die casting. It will, for example, assemble ceramic or alnico permanent magnets to steel shafts, assemble instrument bearing pins in their housings, and mount small gears on shafts with pinions cast integral with the hubs.

Six Steelmaster punching and shearing machines made in Italy by Ficep and assembled in the Pathex plant in Toronto were demonstrated by Pathex Ltd, Buffalo, NY.

Olivetti Corp of America's machine tool division, Long Island City, NY, showed a Model 16 sensitive bench-type drill press, a Model 112 column-type drill press, and an Olivetti Series R4, No. 500 medium-duty cylindrical grinder with swivelling wheel head, all made in Italy. The grinder has an infinitely adjustable speed headstock, carbide-tipped centers, a magnetic coolant tank filter and dial indicators for table positioning.

A large hydraulic press made by Bussmann-Simetag in West Germany especially for compacting powder metals, ceramics, etc, was demonstrated by Mannesmann-Meer Inc, Youngstown, Ohio. Nearby was a large model TF4 Morando hollow-spindle engine lathe with 32-in. swing and a 36-hp motor drive, imported by Steve Allen Machine Tool Corp, Brooklyn, NY, from Torino, Italy. This lathe features a heavy-duty tracing slide equipped with a Vickers hydraulic system, and an automatic threading carriage.

Another large machine exhibited during the Metal Show was a new Dixi 75 horizontal optical jig borer brought in from Switzerland by MBI Export & Import Ltd, Bronx, NY. This machine features very rapid and accurate optical settings (with direct readings of 0.00005 in. or 1 sec of arc). It is claimed that a new dimension can be located within 12 to 15 sec. A Dixi 450 optical precision rotary table can be used on this machine in either the horizontal or a vertical position. For repetitive production, the Dixi 75 can be set for semi-automatic operation by mechanical storage of various spindle locations on long drums. This is done by adjusting position control blocks after optical settings have been made. Positioning accuracy with the control drums is said to be plus or minus 0.000040 in.

Aaron Machinery Co, Inc, New York, displayed lathes, milling machines, engraving machines, grinders and guillotine shears imported from West Germany, Sweden, Denmark, and Italy.

Machine Tool Manufacturers Affiliates Inc, Cleveland, exhibited a number of machine tools imported from France, including a type 44 GSP radial drill a De Valliere "H 130C" precision toolroom lathe, a Ramo T37-6 screw-cutting lathe designed to use Ramo's system of preset tool holders and multiple-position control drums.

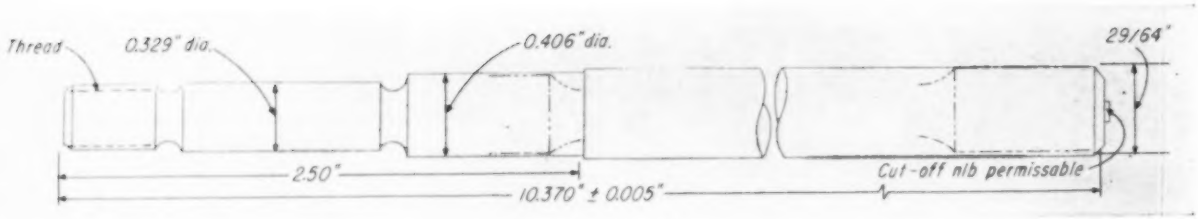
Swiss spark eroder

Ateliers des Charmilles S A of Geneva, Switzerland, exhibited an improved "Eleroda D1" precision spark erosion (EDM) machine. Not far away, in the booth of E G Heller's Son, Inc, Los Angeles, Japanese operators were demonstrating a "Diax" electric discharge machine made by Mitsubishi Shipbuilding, and a Japanese "sparkle" BH-204 electric discharge cutting machine which uses a 0.02 in. thick, horizontally-driven steel band electrode to cut hard metals, stainless steels, carbides, high speed steel, and metal shapes having little rigidity (such as honeycomb assemblies).

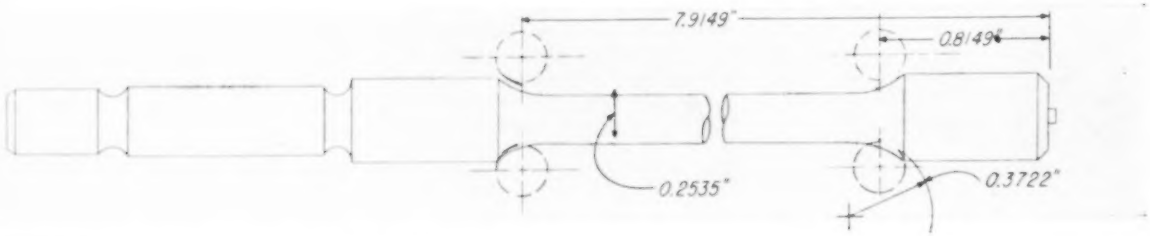
American Pullmax Co Inc of Chicago showed eight different "Pullmax" combination punching, shearing and nibbling machines imported from Sweden. Aktiebolaget Curto of Goteborg, Sweden, demonstrated one of its M-700 high speed wire straightening and cutting machines capable of producing core wires for welding electrodes directly from coils of wire stock at speeds up to 800 cuts a minute, equal to 1060 fpm of wire feed.

Eighteen machine tools, all said to be 1960 models never exhibited before, were demonstrated by S & S Machinery Co of Brooklyn, NY. These included an improved "Manau-Cycle" automatic thread chasing lathe, four "Supermill" universal knee-type milling machines, an Elgin Model A-45 small centerless grinder and an Elgin Model AUC500 universal tool and cutter grinder.

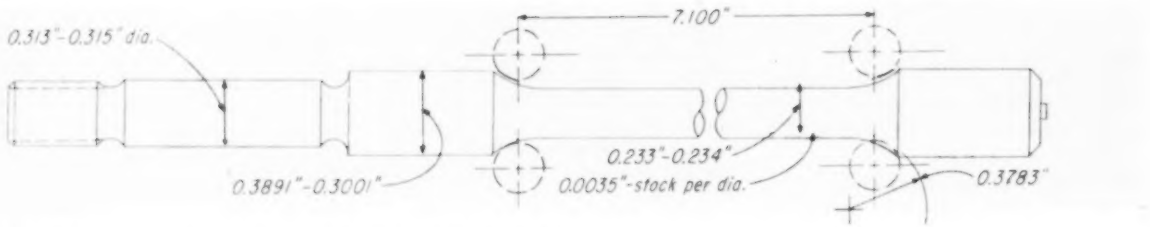
Fast grinding forms small



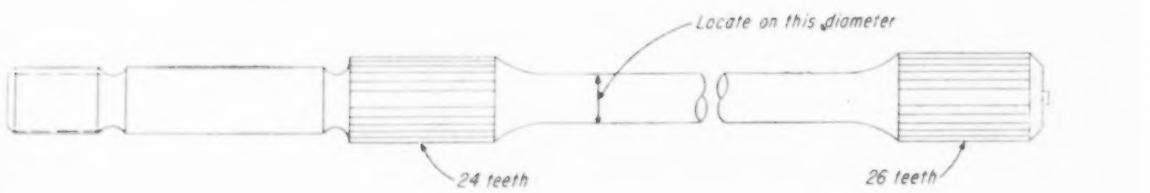
Torsion-bar stock is turned, undercut, chamfered, and threaded, then cut off



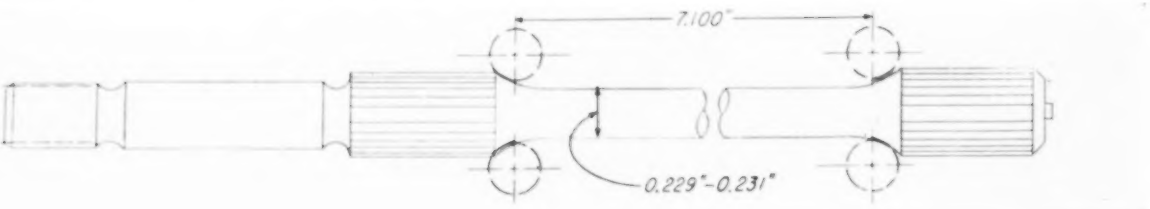
Rough grind produces neck and radii at shoulders



Finish plunge centerless grind semifinishes the neck, finishes ends



Serrations are broached at both ends, with teeth concentric within 0.004 in.



Final grind finishes neck and holds spindle runout within 0.01 in.

torsion bars

By Ben C Brosheer,
Chicago editor

Precision plunge grinding removes metal so fast at Ford's Indianapolis (Lincoln) plant that the operation requires exhaust hoods, coolant refrigeration, and high-flash-point grinding oil. The form grinder takes out an 8-in. section from power-steering torsion bars from 0.4531 in. (on the diameter) to 0.2535 in. in 0.78 minutes cycle time, including automatic work transfer. Few precision form-grinding operations remove metal this rapidly.

Torsion bars are produced from SAE 1144 stress-proof steel hardened and drawn to 30-34 R_c in five operations. Three diameters, two intervening undercuts, two end chamfers, and cutoff are produced in 6-spindle No. 60 New Britain-Gridleys, arranged so one operator can supervise two machines. The bars are for Lincoln power steering.

Then the long neck is rough-plunged to 0.2535 in., holding runout to 0.010 in. tir, on a No. 2 Cincinnati centerless grinder with an automatic feeder. The 8-in.-wide vitrified bonded grinding wheels are 46 grit (46K5VBE).

Three diameters are finish-plunge ground, then the neck is semi-finish plunged to 0.233-0.234 in. with runout held to 0.002 in. tir. This operation is also on a No. 2 Cincinnati, performed with 2A6OL6VL wheels and soluble-oil coolant, taking 0.33 min total cycle time.

Serrations are broached at both ends adjacent to the reduced neck, 23 at one end, 25 at the other. Parts are loaded manually and individually into a special double-end broaching machine so both ends can be finished at once.

Finishing

Finally, the neck is centerless plunge ground to 0.229-0.231 in. to 16-mu-in. finish or better and to no more runout with the other diameters than 0.010 in. tir. This operation is on a No. 2 Cincinnati with an 8-in.-wide 2A8OL6V6 wheel, which takes 0.25 min for cycle time.

Volume requirements are such that an operator can handle three centerless grinders and the broaching machine in this line. He also checks the finished parts in a series of special dial-indicator and air gages, then delivers the torsion bars to an adjacent conveyor degreaser. Later 10% of the parts are Magnafluxed for quality control.

Heat generated in the first centerless grinder is so great that the machine is equipped with an exhaust hood that surrounds the grinding area and is vented to the roof. In addition, a 5-ton Frostrode refrigerating unit automatically keeps the temperature of the cutting fluid at room level.

Also because of the heat a high-flash-point grinding oil is required. It passes through a 5-section Barnes-drill magnetic fluid cleaner that removes the large volume of metal chips and sludge produced. This reduces tool wear and damage to the work.

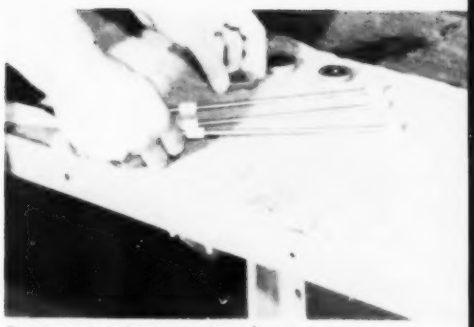
Ring Cutters for Broaching

Serrations at each end of the torsion bars have 45° pressure angles and DP of 64/128 in. These are formed by five disk cutters assembled with four 0.100-in. spacing washers inside a heavy-wall retainer ring in the broach assembly. Cutter disks have OD's of 1.4998-1.5000 in. and thicknesses of 0.1795-0.1805 in.

Hose connections to each broach assembly bring in cutting oil that flushes the broaching rings as they work. The lower part of the front face of each disk is surface ground 0.004 in. below the dished chip-clearance ring, which goes around the circle of broaching teeth inside each disk—to facilitate chip clearance.

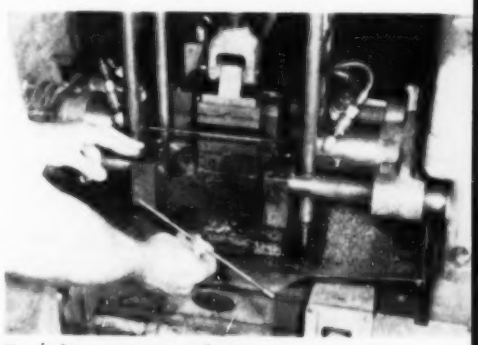
Heat Treating

Cutter disks are M2 HSS, hardened, quenched, and drawn to 65 R_c in molten-salt-bath furnaces, then ground all over. The cutters are centered in the retaining rings by peripheral surfaces that are finished concentric with the major and minor tooth diameters within 0.0005 in. tir. Teeth in the first four disks of a set are relieved 1°30'; those in the fifth

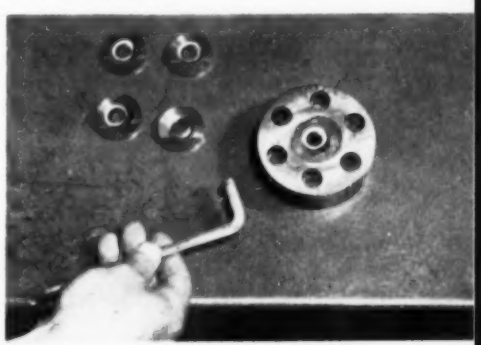


Power-steering torsion bars . . .
Precision gages check bars that connect Lincoln steering wheel to front wheels

Heavy grinding cuts . . .
Exhaust hood and refrigerator keep coolant at normal shop temperature

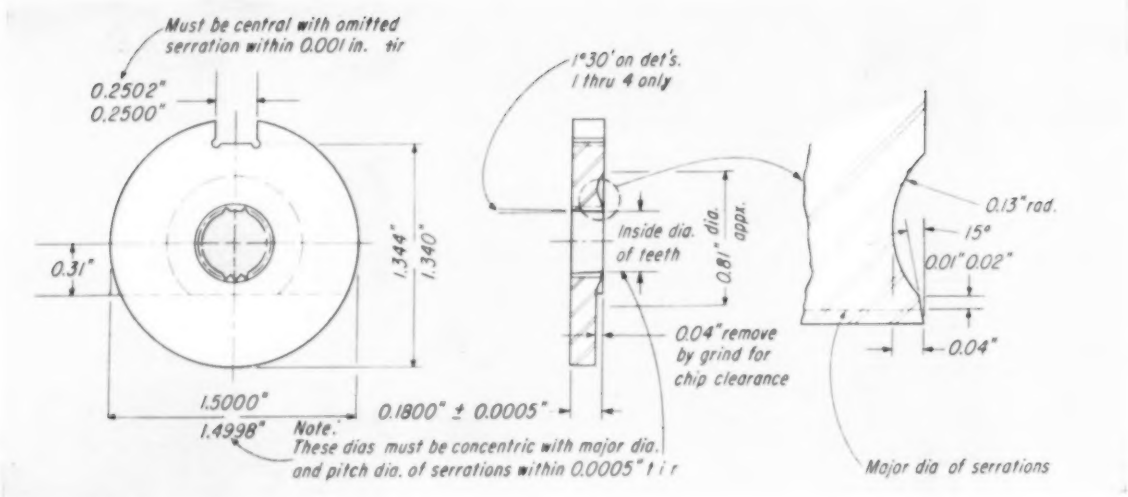


Broaches cut serrations . . .
Both ends of each bar are cut at one time to fit splined fittings

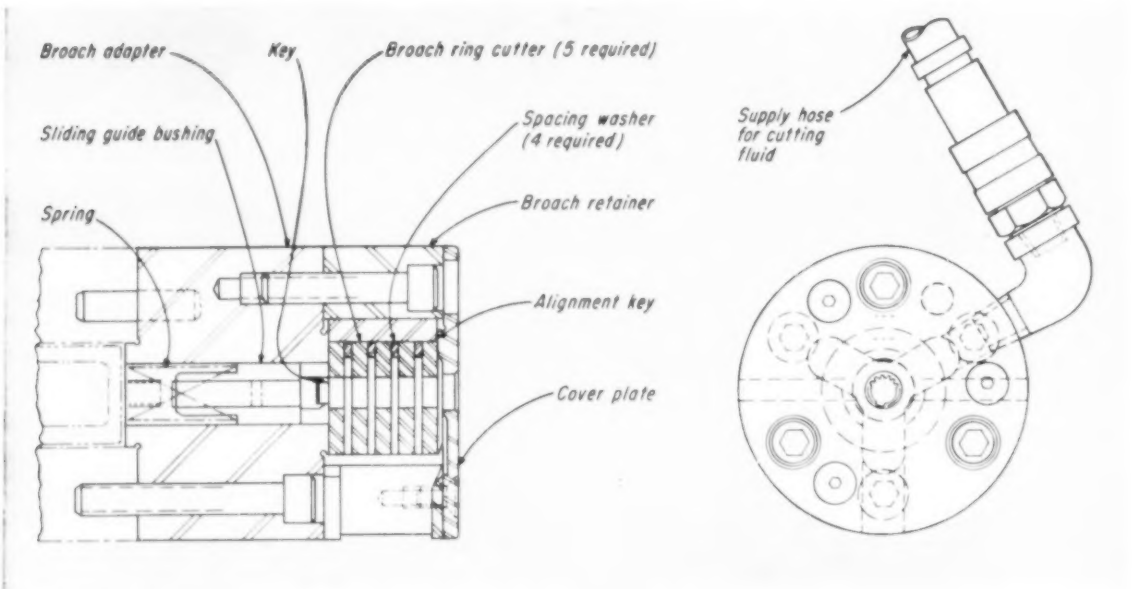


Broaches and holder . . .
Five disks and four spacers are clamped in broaching-head adapter

Fast grinding . . .



Broach assembly . . .
Replaceable cutter disks simplify tool change, reduce costs



Broaching disks . . .
Five disks fit each holder—OD and ID are concentric within 0.0005 in. tir

(finishing) disk are not relieved.

Heat treating for the disks includes:

1. Preheat to 1000 F for 1 hr in molten salt bath.
2. Heat immediately to 1500 F for 1 hr.
3. Heat immediately to 2175 F for 1 1/2 min.
4. Quench in molten salts at 1050 F for 15 min.
5. Air cool to room temperature.
6. Draw at 1000 F for 2 hr, 20 min in recirculating furnace.
7. Air cool at room temperature.
8. Redraw and air cool twice again as above.

Other precision operations required include:

• Keyways in the periphery of each disk, produced by leaving out one serration, must be ground and centered within 0.001 in. tir. The flats formed in the torsion bars must line up within ±zero degrees, 15 min.

• Broach retainers, adapters, and guide bushings are made from oil-hardening tool steel drawn to 58-60R_c. Retainer bores are finish-ground to 1.5001-1.5003 in. for a smooth slip fit for the cutters and washers.

• Hydraulic broaching is done with a bench machine fitted with a vertical hydraulic toggle clamp that holds workpieces individually in a V-slotted alignment block mounted between the two hydraulic broaching heads. These heads are powered from the same pump and valve to cycle simultaneously.

ASTE Engineering Conference hears how . . .

One operation cold forms tube ID, OD

Both inside and outside surfaces of a tube can now be finished at the same time by a cold-forming process developed by Fellows Gear Shaper Co, Springfield, Vt. Furthermore, the inside hole can be shaped round, square, splined, elipsed, grooved, with fins, and so on; and the shape may be twisted (helical) or straight. A gun barrel is one possible application.

The Fellows-Appel process was described before the 9th annual Tool Engineering Conference of ASTE, held October 30 and 31 at Joliet (Ill.) Junior College, by Frank Jones of Fellows. This method can reduce an OD through its entire length, or produce necks at selected locations, form several OD's on the same tube, and create a taper.

Forming is done at room temperature, and is not very different from rotary swaging except that the part is squeezed, not hammered. Individual squeezing or kneading cycles are carefully controlled, and produce work to tolerances closer than a thousandth. Long pieces are treated continuously; short pieces can be hopper fed and loaded automatically. (*AM*—June 17 '57, p186.)

Shaping is done over an internal mandrel by a forming head that has four dies. Work is rotated uniformly to distribute squeeze forces—and the mandrel rotates with it.

Developed over the past $2^{3}/_{4}$ years from an original German gun process, the forming method has produced a hydraulic-cylinder tube 42 in. long with a $2^{1}/_{2}$-in. OD and 2-in. ID with a tolerance of 0.0004 in. and finish of 16 mu-in. The tube was formed from seamless cold-drawn tube stock in two passes—one for heavy reduction, and one for sizing the finished tube. Another example is an internal spline in 304 stainless, formed to size, shape, and roundness equal to the best cutting, broaching, or shaving operation . . . lead is within 0.0002 in. per in. of length.

Production rate is up to 6 fpm, and short parts, even with blind holes, can be turned out at 6-8/minute. The machine operates at 1500 squeezing cycles/min, with adjustable feed and adjustable work rotation. Stainless, carbon and alloy steels, and nonferrous metals can be worked. High-carbon alloys are worked at 50-55 R_c, and fine finishes of 2-3 mu-in. are possible at the same time.

Cold forming produces the usual benefits—higher tensile and yield strengths and hardness without loss of ductility, and often increased resistance to fatigue.

Advantages of the process include chipless forming, continuous size control because the dies are not resharpened, chromed dies to reduce wear, and variable die speed and work rotation with change gears. Two tubes can be assembled together, inside one another, and tapered bores to join the different ID's can be formed continuously.

Thread-rolling economy

Another forming process covered at the same meeting was thread rolling, applied to a power-lawnmower input worm to cut cost from $2.52 to 50¢/shaft—a reduction of 80%. Edward C Hanna of Landis Machine Co showed how thread rolling reduced stock cost—1 to 2 lb of steel was eliminated per shaft by starting with a diameter equal to the thread-pitch diameter instead of a larger size. Three other reasons for the spectacular economy were: thread-rolling speed of 8/min, surface workhardening that eliminated carburizing or hardening, and rolling accuracy that eliminated finish grinding.

Two factors are of prime importance; rolled thread depth requires power, and the deeper the thread is rolled, the more chance to distort the shaft. However, double threads can be rolled deeper than single or triple threads because opposed dies balance thrust forces. The second point: pressure angle should be as close to 20°-25° as possible, though $14^{1}/_{2}$° angles can be rolled. Mr Hanna also mentioned that his company is making progress in gear rolling, and will have an announcement at some future date.

Building-block standards

Ford Motor Co put its Falcon on the production line in 14 months, and, because of building-block line construction, saved $1 million on tooling in the process. H Laverne Cogswell of Barnes Drill Co discussed machine classifications that implement such a building-block program. These cover single-station machines; one, two, three, four, and more than four-way; multiple-station machines; transfer, dial, trunnion, center-column, and shuttle; and main components that form these machines; main base, wing base, way-type feed unit, quill feed unit, horizontal angular adapter, angular column, dial wing-base adapter, and vertical column.

These classifications will soon make it possible to purchase from any of a number of manufacturers the components of a production machine. The concept will allow temporary storage and later use of older units with new units, combined to produce different parts with different fabricating cycles.

The equipment is built to standard work height and in several sizes to accommodate different classes of work and different production rates. Small units should be able to penetrate industries that work in relatively small quantities.

Life expectancy of major capital equipment built to building-block standards should be much higher than non-standard machines, and appropriations for standard equipment should be easier to get.

Control systems

Numerical control applied to production was covered by L B Musser, Bendix Aviation Corp, Detroit. One of the important advantages of NC is that it reduces operator control and thereby increases the level of accuracy in machining.

Some of the economic advantages of NC were noted; increase of machine versatility, reduction of cycle time, allow closer tolerances, increase production, reduce costs, and conserve labor skills. There are three basic NC methods; a positioning system that indicates only a final point (as for drill locations), a straight-line point-to-point system (primarily for turning), and continuous-path control (for profiling and milling).

More than 40 such systems are being developed or available now.

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U S must double current machine tool buying or face disaster, AMTDA told

If the current demand for machine tools is not stepped up substantially, and maintained at more than double the 1959 level, we in America will have to become accustomed to being internationally a third-rate builder and user of machine tools, James O Ellison, president American Machine Tool Distributors Association, told members at the 35th annual meeting at the Statler-Hilton Hotel in St Louis Oct 25-27. The problem is to get American industry back into use of new machine tools at the same rate at Europeans. If this cannot be done, the consequences for this country will be disastrous.

European apprentice training

Mr Ellison was impressed by the top-grade apprentice training program in operation at almost every European plant that he visited. Boys are started into training at 14½ and are made into journeymen. By the time they are 20, they are attractive to any builder anywhere. Such a program here, he said, probably would run into union opposition.

Top engineering talent among European machine tool builders has been directed toward developing up-to-date sophisticated high-production machines rather than general-purpose machines, Mr Ellison observed. But European special machinery still is not an immediate threat to the U S domestic market. The so-called precision manufacturing techniques so often credited to European builders are purely a myth, in Mr Ellison's opinion. He said that he did not see any instances of ultra-precision or radical departures from techniques used here (though he admittedly did not visit certain Swiss plants).

Credit requirements of companies financing the leasing of production equipment are tougher than banks, D P Boothe Jr, president Boothe Leasing Corp, San Francisco, said during a panel discussion on "Financing the Order." The buyer, in fact, must have a better-than-normal credit rating. The principal reason for leasing instead of buying is to maintain a company's capital intact. Leasing, Mr Boothe suggested, is most useful in the field of government contracts where firms with R&D orders can charge rental costs for production equipment. Many companies with net worth of $3-$7 million look upon leasing as a term loan. About half Boothe's leasing is in machine tools.

The case for leasing

Frank K Griesinger, assistant treasurer Lincoln Electric Co, revealed during the panel discussion that his company's excess cash is better used in leasing than invested in bonds. He pointed to the profitable fringe market supplied by some firms as an aftermath of leasing. Example: When IBM gets back used equipment from a lessee, it sells it at a reduced price to a customer who could not afford to purchase it new. Mr Griesinger also stressed rentals from leasing contracts as a good source of income for machine tool builders during so-called "famines."

That leasing should not be regarded as a gimmick to save taxes is a fact that should be made plain to every customer, Joel Barlow, tax authority and partner in Covington & Burling, Washington legal firm, warned. Whenever a leasing arrangement is under consideration, the sales engineer on the job should be consulted because of his knowledge of the entire situation Mr Barlow advised. The panel, with T Laurence Strimple, president National Acme Co, Cleveland, as moderator, agreed that a purchase option should be avoided because it is frowned upon by the Internal Revenue Service.

India sets up six new metalworking projects

India's upcoming Third Five Year Plan (1961-1965) will include six major industrial projects:

- An alloy and tool steel plant.
- An integrated heavy electrical equipment manufacturing project.
- A heavy machine-building project.
- A heavy structural shop.
- A heavy plate and vessel works.
- A machine tool works.

Along with the heavy-machine building project will be a heavy forge shop and foundry.

Emphasis of India's Third Five-Year Plan will be on machine building to fill a growing gap between demands of increasing industrialization and production of machinery.

After a year of setbacks and disappointments..

Capital spending will boom in 1960

This year will go down on the record books as the one in which the prolonged steel strike nipped a promising capital spending upsurge in the bud. But 1960 will tell a vastly different story — all business' spending for new plant and equipment will come close to 1957's high of $38.4 billion, topping this year's spending by at least 10%.

Metalworking industries will do more than their share in chalking up new spending records in 1960, expect to spend 15% more next year than this for a total of $3858 millions. **Business as a whole will spend an astronomic $11,957 million on capital goods in 1960, contrasted with $10,025 million in 1959 and $9761 million in recession-hit 1958.**

'59 a disappointment

Those are the findings of the new McGraw-Hill Economics Department fall survey of business plans for capital spending. The fall survey, which acts as a check on a preliminary survey of such plans made earlier in the year, found that 1959 failed to live up to spending expectations solely because of the unpredictably prolonged steel strike this fall.

Among the metalworking industries, manufacturers of machinery (other than electrical) plan to do the lion's share of capital spending in 1960—$1161 million, compared with 1959's $951 million—a jump of 22%. This jump will be equalled percentagewise, if not in actual dollar volume, by the makers of electrical machinery. Spending in this category will rise from $477 million this year to $582 million in 1960.

An even more spectacular percentage jump will be recorded by the autos, trucks and parts industries: a 30% rise from 1959's $647 million to $841 million in 1960. This marks the auto industry's emergence from a long period of capital spending cutbacks, during which it has attempted to amortize and use up the tremendous extra capacity it created in 1956, following the spectacular 1955 boom in car sales.

Even the "other transportation" category, which includes the hard-hit-by-cutbacks-and-product changeovers aircraft industry, expects to spend 10% more next year than this for a total capital outlay of $399 million.

Only sour note in the 1960 metalworking spending outlook is the "other metalworking" category, which anticipates a 1% drop from 1959's $880 million to $875 million in 1960.

Iron, steel spending up

The iron and steel producing industry is slated to make the most spectacular increase of all manufacturing industries—rising 76% from 1959's $949 million spending to $1670 million in 1960. This is because the iron and steel industries chose 1959 as a year to "live off their own," in other words to make use of excess capacity rather than to build new plant.

The nonferrous metals industry, on the other hand, will show a slight but steady gain of 3% over 1959's $347 million outlay.

All manufacturing industries combined will spend $11,957 million in 1960, a 19% gain over 1959's $10,025 million. At the same time, all business (which includes all manufacturing) will increase its outlays 10% in 1960—from $33,914 million to $37,310 million.

Next year will be a year in which capital spending will outpace anticipated increases in sales, marking an optimistic outlook for the future. For example, metalworking companies as a whole expect a sales increase of 9.6% but they will spend 15% more on capital goods in 1960. This is also true of the iron and steel industry, which expects a 25% sales increase in 1960, but at the same time will up expenditures for new plant and equipment by 76%.

Within the metalworking category, machinery makers expect an 11% sales rise, but will spend 22% on capital goods. Electrical machinery makers' sales will go up 11%, spending 22%; automakers sales 15%, spending 30%; transportation equipment sales 4%, spending 10%. Lone exception is the "other metalworking" category, in which sales are expected to rise 7%, while spending will drop 1% in 1960.

Manufacturing as a whole expects a 1960 sales increase of 9%, but its capital spending outlays will increase about 19%.

Capital spending plans of manufacturing firms (millions of dollars)

	1958 (actual)	1959 (Est.)	1960 (planned)	1959-60 % change	1961 (planned)
Machinery	$ 915	$ 951	$1161	+22%	$1129
Electrical machinery	459	477	582	+22	559
Autos, trucks, parts	558	647	841	+30	791
Transportation equip. (incl aircraft, ships)	370	363	399	+10	359
Other metalworking	723	880	875	— 1	844
ALL METALWORKING	3025	3318	3858	+15	3682
Iron & Steel	1217	949	1670	+76	1169
Nonferrous metals	510	347	357	+ 3	350
Chemicals	1320	1188	1473	+24	1502
Paper & pulp	578	613	828	+35	704
Rubber	134	178	233	+31	247
Stone, clay, glass	399	542	603	+11	594
Petroleum refining	665	692	754	+ 9	814
Food & Beverages	742	794	783	— 1	737
Textiles	288	343	361	+ 5	350
Miscellaneous mfg.	883	1061	1037	— 2	1022
ALL MANUFACTURING	9761	10,025	11,957	+19	11,171

New gear quality specifications on way

Reports that the present system of specifying gear quality would be revised and extended were confirmed recently when open discussion began on the proposed new Gear Specification Manual of AGMA. In the new system, which will cover both coarse- and fine-pitch gears, there will be fourteen classes to cover the range of gear quality normally available.

The proposed new manual has been developed by a committee headed by C R Burrell, Tool Steel Gear & Pinion Co, and draft copies are now being discussed by members of the American Gear Manufacturers Association. One session at the recent AGMA meeting in Chicago was devoted to the draft manual.

Target date for adoption of the system is believed to be June 1960.

New classifications

The fourteen classes of gears will be Class 3 to 16, with the higher numbers representing the more precise gears. The table below shows the equivalent current classes in the fine-pitch system. The new system will apply to both coarse and fine pitch.

Two classes are added that are more precise than the present Precision 3 gears. Class 15 would have a total composite tolerance of 0.0002 in. and a tooth-to-tooth composite tolerance of 0.000,10 in. Class 16 would require a total composite tolerance of 0.000,15 and tooth-to-tooth of 0.000,07 in.

The new manual would apply to gears in the fine-pitch range, 20 diametral pitch and finer up to 10 in. dia, and in the coarse-pitch range, 19.9 diametral pitch to 1.2 diametral pitch up to 200 in. dia.

Systems compared

Comparison of present and proposed fine-pitch gear systems:

PRESENT	PROPOSED
Commercial 1	Class 3
Commercial 2	Class 6
Commercial 3	Class 8
Commercial 4	Class 9
Precision 1	Class 10
Precision 2	Class 12
Precision 3	Class 14

The new gear specification system will cover spur, helical, and herringbone gears from the crudest cast tooth to the most precise cut tooth obtainable.

Allowable tolerances have been established for profile, run-out, pitch variation, and lead. In addition tooth-to-tooth composite and total composite tolerances are established for the more precise classes.

The manual will include suggestions for gear class, material, and heat treatment for specific uses in each industry. Members of AGMA have been asked to submit suggestions for improvement in the proposed manual by no later than March 15, 1960.

Steel shortages cloud tool and die industry outlook

Instead of being the bellwether of recovery (its traditional role in a rising metalworking economy) the tool and die industry today is not much better off than it was in 1958. Through August, the industry had shown a gain in orders of only 11% over last year, and it will probably finish this year 15% ahead of 1958, with falling backlogs in certain centers.

These facts were brought out in a series of informal interviews with industry executives attending the 14th annual Membership Meeting of the National Tool & Die Manufacturers' Association at the Statler-Hilton Hotel in New York, November 4-8.

Tool and die industry has not kept pace with that of metalworking as a whole for several reasons. For instance, electronics orders are strong and so is farm equipment business—even though the latter industry hasn't yet gotten around to tooling up to take advantage of huge R & D expenditures in the last few years. And the auto industry's tooling program for 1961 models thus far is largely in captive shops.

Spot checks of conditions in various tooling centers show:

● **New England:** Hartford is active while Bridgeport is poor. In some cases, shops have run out of tooling work, are doing production jobs to survive.

● **Metropolitan New York City** (Long Island, Westchester, Bronx): Stamping producers, hit heavily by steel shortages, still refuse to pick up steel at excessive prices in the gray market because customers won't pay the increased cost for stampings. Tooling programs are therefore being delayed, and uncertain supplies of metal are causing tool buyers to refrain from tying up money in tooling until the situation improves.

● **New Jersey:** Some orders for cold forming tools are being let. The electrical industry is quite active. Average shop is running 4 to 6 weeks' backlog, and operations are scheduled one shift, 44 to 48 hours per week. Employment is at a peak, and shops are looking for men. As in other centers, supplies of tool steel are adequate, but there is a pinch in plate, shafting, cold drawn.

● **Cleveland:** Some shops are slow but the leaders are getting business. Area has not had defense business for something like 14 months, mainly because of the changeover from aircraft to missiles, and Cleveland has no missile business. Large firms with captive shops are pulling back work.

Bright spots: one shop is working two shifts, has already finished some 1961 auto tooling, is working on more. Another leading shop reports October was its best month of the year, and bookings are strong this month. Communications industry is coming to life, and the vanguard of orders for 1961 auto tooling, heralded as the largest in years, is beginning to break.

● **Rochester** is running at about 60% of capacity, with key workers being given long vacations so that they will stay on payrolls. Independent shops aren't getting work.

● **Detroit:** Independents report 37% of their men have left to work in captive or non-union shops. Current rate is estimated at 30% of capacity on large body die work. Auto plants are making more than 60% of their tooling.

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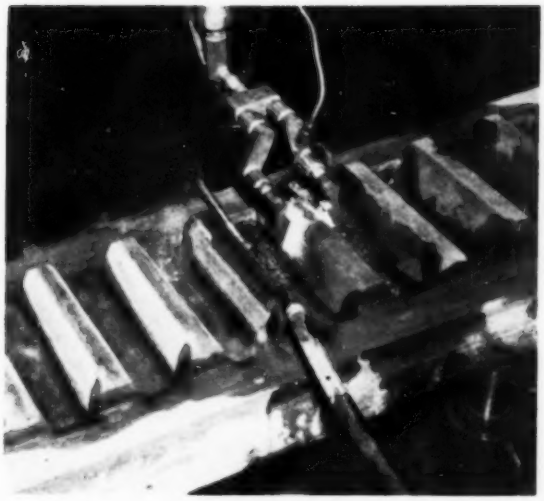
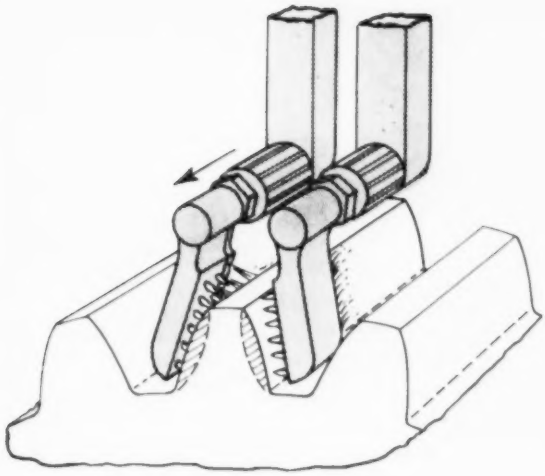




Flame hardening a gear rack . . .
requires hardening the flats along both edges and the individual gear teeth. Rack is about 10 ft long, has 26 teeth, is used in a rolling mill. Flats were heated with standard flat burners; the teeth with standard gear-tooth burners like those at right

The key to better flame hardening:

Match the burner to the job

By B G Ward, Jr.
heat treatment engineer,
National Cylinder Gas,
Div of Chemetron Corp, Chicago, Ill.

Flame hardening or induction hardening—which would be better? Long the subject of discussion, this choice could usually be resolved clearly in favor of one or the other method. But now, with the recent advances in gas-mixing equipment, operating controls, and burner design, the arguments have been reopened, and flame hardening is finding new and varied applications.

Production quantity should be one of the first considerations when you are choosing between induction and flame hardening, if both processes can provide the desired hardening pattern. Other things being equal, flame hardening is more suitable for short runs, induction hardening for longer runs.

Among other factors to be weighed are:

Initial cost — Original equipment cost is much lower for flame hardening than for induction hardening for a particular arrangement. Price differential increases with part size.

Flexibility—Flame hardening provides greater freedom in treating large areas with deep, often varying, penetration.

Complex shapes—Burners are easily located for hardening complex contours, whereas it may be difficult to position induction coils to harden gear teeth, clutch components, or internal surfaces.

Automatic control — Induction hardening at one time provided superior process control, but recent advances in automatic flame hardening controls now provide a high degree of reliability and uniformity adequate for any hardening job.

Burner styles

Assuming that flame hardening has been selected for a job, the heat treating specialist must then determine the best type of burner and the best flame-hardening method. Poor selection here can adversely affect both the quality and the cost of the final product.

The burner itself may have almost any specified contour on the flame face, and can be provided in multiple units for particular hardening setups. Quenching can be built into the burner head itself, be provided by a separate quenching head, or be done as a separate operation after flame heating. Multiple burners can be fed through separate gas mixers and controls from the gas supplies, or all the burners can be fed from a single manifold and a single set of controls.

What kind of burner should be used? This depends, of course, upon the job in question, but there are four basic types of burners—all with their inherent advantages and disadvantages:

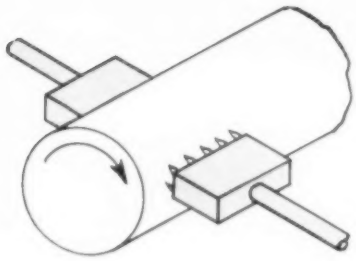
Welding tip—Standard torch head delivers heat to a relatively small circular area. This is the least expensive burner, but it is practical only for hardening small parts or limited areas of larger parts.

Flat—This type of burner allows full freedom in specifying dimensions of the flame face (provided fuel supply is adequate). The flat burner is relatively inexpensive if it is possible to make a selection from among the standard flame-face dimensions and heating capacities available.

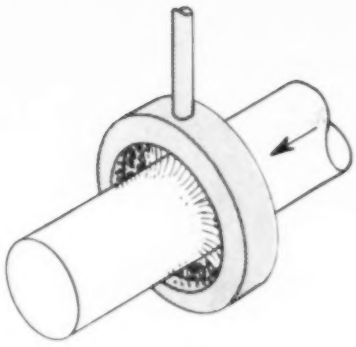
Contoured—The flame face of a contoured burner can be shaped to match the workpiece contour. These burners must be custom-built but may be more economical to operate than a combination of less expensive flat burners, because of reductions in hardening time and fuel consumption.

Ring—Ring burners can be built to any diameter and thickness. They also come in standard sizes, though a special diameter must usually be

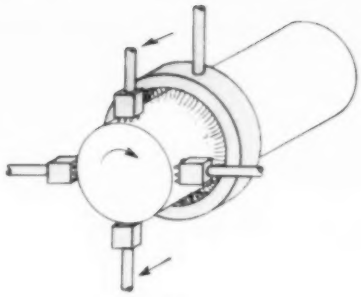
Flame hardening . . .



Shafts 1a



1b



1c

specified to match a non-standard shaft size.

Flame-hardening methods

There are four basic flame-hardening methods:

Stationary—Both the burner and the workpiece are stationary during hardening. Total hardening area may be increased by indexing the piece or burner after each heat-and-quench operation.

Stationary spinning—Burners are stationary; piece rotates or spins under the flame to extend the hardening area. Pieces are usually circular, though it is possible to vary the burner position so as to follow a rotating, non-circular piece such as a cam. Stationary spinning may also be used simply to insure more even heat distribution, as in hardening a shaft with a ring burner.

Progressive—Piece is stationary; burner moves at a constant rate across the surface to be hardened. Quenching is also progressive, either separately or following on the burner head. It may be advantageous, too, to combine a stationary burner with a progressive part.

Progressive spinning — Both the burner and the piece move. The piece spins under the flame as the burner progresses in an axial direction.

Applications

The bulk of flame hardening work in industry can be broken into eight categories, namely:

- Shafts
- Machine ways
- Internal bores and splines
- Gears
- Racks
- Journals
- Cams and camshafts
- Sprockets

The particular burner and flame hardening technique used to treat pieces in each of the groups are shown in the illustrations on pages 136-7 and are discussed in the text.

Shafts

The best burner for hardening a shaft often depends upon shaft diameter. Very small shafts, less than 1 in. dia, can be hardened by a welding tip, by either the progressive spinning or stationary spinning method. Small shafts can be hardened by one or two standard flat burners (1a) with progressive spinning or, if only a narrow band need be hardened, with stationary spinning. If the burners have quenching nozzles, the shaft should be hardened by upward progression in a vertical position so as to lose the quench water. The vertical position is preferred for long, thin shafts because it eliminates the need for auxiliary shaft support.

As in all progressive flame-hardening, burner travel rate along the shaft should be from 2 to 12 ipm, depending upon heat capacity of the gas mixture and burners, and the penetration desired.

The combination ring burner and quench (1b) can heat shafts of any diameter. Progressive hardening with ring burners involves motion of both burner and shaft. The shaft should always be spun to insure uniform hardness and to minimize distortion. Quenching can be built into the ring burner head, be supplied through a separate head, or be done as a separate operation after heating.

Progressive spinning is usually applied to large-diameter shafts through multiple flat or segment burners and a ring quench (1c). The number of burners for a given shaft diameter depends upon the progression speed. A 1-in.-wide burner can conceivably harden a 6-in. shaft, but the burners must move very slowly along the shaft, and no matter what the burner arrangement, gas consumption is going to be high.

The ring burner, however, is usually most economical for shafts of any size, both in terms of gas consumption and also, with respect to multiple burners, because only one torch handle, gas mixer, and set of controls are necessary.

Machine ways

Flame hardening of flat and lathe-bed ways is always done progressively because of the size and weight of the work, but burner arrangement may vary a good deal. Flat ways (2a), such as those on boring and drilling machines, are usually heated with separate burners provided the production run is not too large. Ways may be produced by a company in several widths but with uniform depth. In such cases, one set of side burners may be used for a number of way sizes. A separate top burner, however, should be specified for each way width to insure uniform heat distribution.

Lathe-bed ways can be flame hardened with (a) one burner in three passes, if the widths of the sloping sides and flat are the same; (b) three separate burners in one pass (2b); (c) two burners on the "V" in one pass and another burner on the flat in a second pass, or (d) a special contoured burner with three separate flame faces in a single head and with a common gas mixer, supplied through a single gas control system.

A single burner making three passes is clearly the lowest in initial cost, but it is too slow. The most practical method, both in initial and operating costs, is three standard burners in one pass, though, if quantity is sufficient to offset the higher initial cost; a specially contoured burner is simpler and usually provides more uniform hardening. All the burners shown for hardening ways have integral quenching ports, though separate progressive quenching is possible.

Internal bores and splines

Small bores can be flame-hardened with a circular burner and quench (3a). Although simple progressive treatment is possible for deep bores,

a more uniform heat distribution is achieved by spinning the piece at the same time. The motion of the circular burner should be upward, so that quench water falls down through the bore. Stationary spinning is sufficient if the bore is shallow enough to permit a practical burner width, and if quenching can be done afterwards. Circular burners become impractical to make in sizes below ¾ in. dia.

Large bores may be hardened by stationary spinning with one or more flat burners. If the ring or bore is shallow enough, it is rotated until hardening temperature is reached, then the burners are removed and the quench heads are inserted. The number of burners required depends upon the diameter and depth of the part and the burner travel speed.

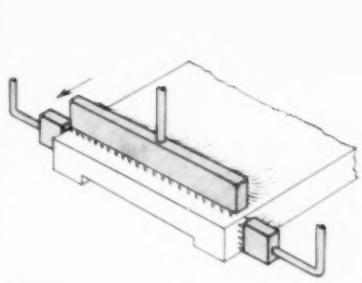
A single flat burner may be used for progressive hardening of extremely large bores if the spinning method cannot develop proper hardening temperature and quenching around the entire bore. To prevent tempering an already hardened area, install an auxiliary quench just ahead of the burner (3b). Only one burner should be used in this setup. The burner and primary quench should be located at the top of the bore, or the bore ring should be hardened in the horizontal position. The width of the hardening area, of course, depends on burner width; the burner may be indexed over for more than one pass.

Spline hardening is quite similar to internal bore hardening. Stationary spinning is acceptable for narrow splines, up to about 2 in. wide. Progressive spinning produces less distortion and is useful on splines from 2 to 8 in. wide. Both methods, of course, produce the full-tooth hardening pattern shown in Fig. 4a. If only the spline faces are to be hardened, progressive hardening with two burners traveling along each tooth cavity should be specified. This is similar to the gear hardening operation in Fig. 4b.

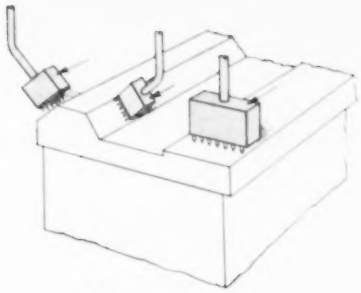
Gears

Gears can be hardened in three ways. If the gear teeth are less than 1/2 in. wide, a twin welding tip can heat each side of a tooth simultaneously. The gear is then indexed, and the heated tooth is quenched as the next tooth is heated. Multi-flame tips may be used for teeth over 1/2 in. wide.

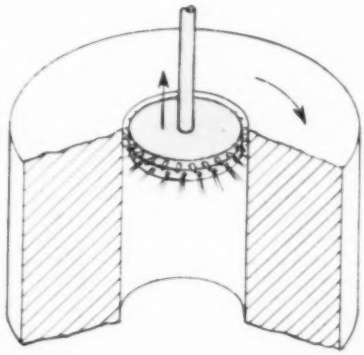
Gears may also be hardened by the spinning technique, using standard flat burners. The gear is spun under



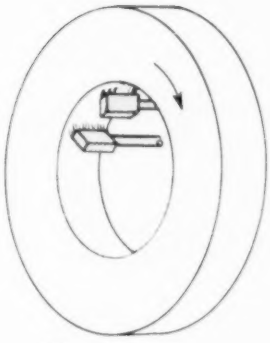
Ways 2a



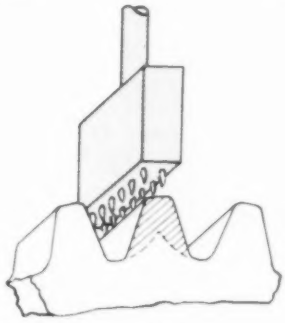
2b



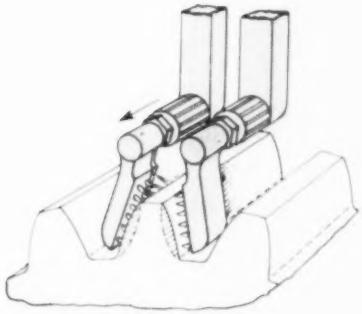
Bores 3a



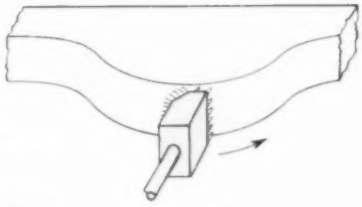
3b



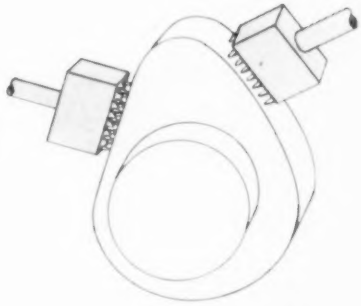
Gears 4a



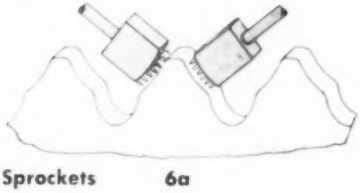
4b



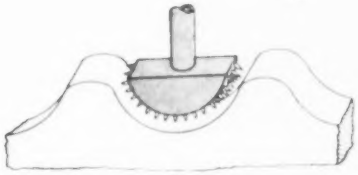
Cams 5a



5b



Sprockets 6a



6b

the burners until the teeth have reached hardening temperature, then the gear is dropped into the quench or indexed to a spray quench. Spinning provides the hardening pattern shown in Fig. 4a, and can be used for gears up to 24 in. in diameter and 4 in. wide.

Progressive hardening is accomplished by two flat or contoured burners moving simultaneously across the working faces of each gear tooth (4b). As in stationary gear hardening, heating on one tooth is followed by indexing and quenching. Although slower than stationary spinning, progressive hardening is usually specified (a) when only the working faces of the gear are to be hardened usually in heavy gears subject to high shear stresses; (b) when gears are quite large, over 24 in. x 4 in.; and (c) when gears are special designs for precision machines.

Racks

Because of the length of the teeth, racks are almost always hardened progressively (see photo on p 135). Twin tips like those in sketch are commonly used.

Journals

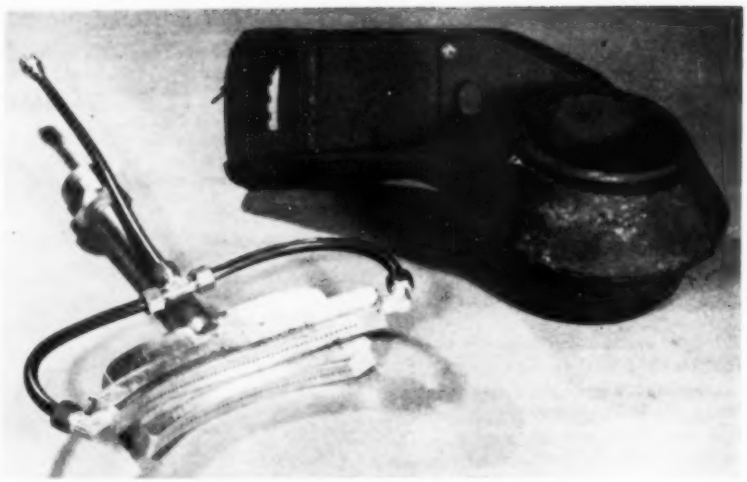
Journals are usually hardened by spinning, in much the same way as shafts. Heating is followed by a quench. Progressive hardening, in which the burner and quench travel around the journal shaft, is possible, but soft spots might develop at the end of the cycle.

Cams and camshafts

Most linear cams are hardened progressively in a horizontal position with a flat burner and quench (5a). The contour of the cam can be followed by adapting a duplicate cam, by placing a follower guide in front of or behind the burner, or by positioning the burner by hand.

When only limited areas of the cam need be hardened, the stationary method can be used, as in Fig. 5b, where we show two separate areas being hardened. A slightly greater hardening area and more uniform heat distribution can be obtained by oscillating the cam itself, not more than 15°, under the burners.

Progressive hardening is often specified when the entire cam profile is to be hardened and the piece is being made in reasonable quantities. Cam rollers move the burner and quench in and out as the cam rotates. Progressive cam hardening is best carried out in a horizontal position.



Special contoured burner . . .
hardens the curved and raised trapezoidal surface on this cast-iron disk plow hanger. Surface was initially hardened with a standard flat burner traveling across the long dimension. This contoured burner moves at the same speed across the short dimension, cutting travel time by two-thirds. Burner has integral quench

Sprockets

Two flat, or slightly contoured, burners may be used in stationary hardening to heat simultaneously both sides of each sprocket tooth (6a). After heating, the burners automatically withdraw, and the sprocket is indexed for quenching. Sprockets (and gears) may sometimes be stacked to allow progressive hardening along each line of teeth. This can save considerable time, and improve heat distribution. In Fig. 6a only the tooth tip is hardened. In Fig. 6b the root is also hardened. The application determines which of the hardening patterns is required.

Case histories

Gear rack

The gear rack pictured in the flame hardening operation on page 135 is about 10 ft long, and has 26 teeth, the wearing surfaces of which are about 2 in. deep by 4 in. wide. In this application both the teeth and the flats along the edges of the rack must be hardened.

First, a standard 2-in.-wide flat burner with built-in water quench and cooling system was used to progressively harden the full length of one flat, then it was shifted to return along the opposite flat. Bolt holes in the flats were filled with metal disks to prevent burndown around the hole edges. Burner speed is 4½ ipm.

The gear teeth are then hardened with a pair of standard gear-teeth burners (sketch, p135). An auxiliary quench directs water on top of the tooth, between and behind the two advancing burners; a compressed air siphon just in front of the burners removes water collecting between the teeth. Burner speed on the teeth is 4 ipm.

Disk plow hanger

The curved and raised trapezoidal surface on the front of the disk plow hanger shown above had to be hardened because it drags on the ground and could wear away quite rapidly. This surface, 2 in. high, 5 in. long at the top, and 7 in. long at the bottom, was hardened initially by 2-in.-wide flat burner traveling across the long dimension. The manufacturer felt that the operation took too long. Consequently, the contoured burner-and-quench (illustrated) was designed to match the surface contour. The burner now progresses across the short dimension (top to bottom) at the same speed (about 6 ipm) as the flat burner moved over the long dimension. Burner travel time was reduced to about 20 seconds, one-third of the time previously required for the job.

Deep-drawing with three dies

By H W Schulze
manager of operations
Range & Home Laundry Div
Philco Corp, Philadelphia

A few simple shop tricks, a 750-ton Clearing hydraulic press, and three dies are deep-drawing 14-in.-deep automatic home washer tubs from 12-gage cold-rolled steel without tearing. Setup at Avco Mfg Corp's Home Appliance Division, Nashville, also involves heating blanks with infra-red lamps.

Largest of the three dies is centered on the press bed to make the initial 14-in. draw from the 36-in.-dia circular blank, producing the center piece in photo. This piece has a stepped bottom with a center that projects outward. Tearing, so common in deep drawing steel of this gage, has been eliminated by two simple methods: (1) applying a small amount of dry soap at some points on the blank just before it is placed in the die, and (2) heating the blank to about 110 F with a bank of infra-red lamps suspended above the stack of blanks, just before the blank is placed in the circular shear.

The circular shear, which is loaded and operated by the pressman while the draw of the previous blank is being made, saves Avco money because it eliminates having to tie up a heavy blanking press that is run by another operator. Operation of the shear has only a slight effect upon the draw press cycle. Some cooling of the blank occurs while it is in the shear, but not enough to affect the draw adversely.

After the initial draw, the operator removes the drawn piece from the central die and places it in the die at right in the photo. This die makes a reverse draw in which the central projecting portion of the bottom is forced upward, producing the dish (at right in front of press in photo).

In the third die (left in photo), the dished portion is restruck, its center pierced out, several holes are pierced near the OD of the dish, and the flange left by the draw die is sheared off.

At the start of the press cycle, there is a blank in the central die, and there are partly formed workpieces in each side die, but operations in all three dies are performed in one working stroke. The operation requires one operator and a helper.

That's how Avco deep draws inner tubs for Philco Automagic washers. Outer tubs, however, are not only too deep for drawing but have a shape that includes a circular channel section near the top, and because this channel constitutes an undercut, it cannot be drawn. For this reason, Avco produces the outer tub (minus its shallow-drawn bottom) by rolling a cylindrical shell and then mash welding the two mating edges.

Shells then go into a Wallace expander. Lowered into the correct position, the shells are then stretched and formed (including the annular channel portion). Both the interior and exterior dies of the expander then retract, freeing the piece, which is elevated and lifted off, leaving the expander ready for reloading.

Not only can the expander hold to close limits, it can produce the annular channel as well as the irregular collar above it.

This stretching and stressing tends to strengthen the metal, and the annular channels also add to its rigidity. Precise sizing insures a close fit with the flanged bottom, which is joined to the outer tub by a circular mash seam weld. If the weld lacks adequate strength, it will split in the expander.

Three-die press setup . . .
Clearing hydraulic press is equipped with three dies, largest of which makes the deep-drawn part (center). Side die at right makes a reverse draw, producing dished bottom. Die at left pierces holes, shears off flange

Expander shapes outer tub

MATERIAL DESCRIPTION

ALUM COLD ROLLED SHEET 12002CA
SOFT BENDS 180
SUPERSEDES 7601 12
EX DES 2 OF .040 × .875 AL 12002CA105
2 × .750 OF .040 AL 12002CA105

TKS	WIDTH	LENGTH	TOLERANCE TKS	TOLERANCE WID	LB PER SQ IN
.005	12.	72.	.001	.063	.0005
.009	3.	72.	.0015	.032	.00088
.010	12.	72.	.001	.063	.0010
.020	12.	72.	.0015	.063	.0020
.040	.875	72.	.002	.032	.0040
.045	8.	72.	.002	.032	.0044

Machine coding improves material

A code number, adaptable to electronic tab equipment, has replaced the specification number for each material item carried in stock at this plant. Result is an improved catalog of materials, less expensive to reproduce and maintain.

By G M Barrow (ret'd) and R H Lewis, mfg engr, services section, Meter Division, Westinghouse Electric Corp, Newark, NJ

A ten-character, machine-tabbed code, one for each of some 6000 raw-material items. That's the basic ingredient of a new material-inventory system that has improved material control at a Westinghouse Electric Corp plant. Now the same code number identifies an item by one number throughout all design, purchasing, and manufacturing operations.

At Westinghouse's Meter Division (Newark, NJ) plant, the code appears on all the plant's

- drawings
- purchase orders
- storeroom records
- operation cards
- cost and accounting records

Key to success of the system is the use of electronic tabulating equipment. Because the tab machine cannot recognize a material by description, company planners assigned a code number to each material specification. The basic specification code has five figures and two letters; the operating divisions add their own three figures that identify size of materials. This ten-character number adapts each material item to tab-machine processing. Thus it is not simply an arbitrary account number, but has significance to all plant departments.

Collectively, the codes (together with material descriptions) form what Westinghouse calls its standard book: a catalog of approved materials authorized for stock. The materials standard book identifies materials so that they can be specified uniformly on drawing bills. It also supplies data to guide engineers and designer working on apparatus or manufacturing processes.

Old standard book . . .

A portion of a page from the former standard book appears to the right. Each page, typed on an 8 1/2 by 11-in. multilith master, was reproduced, then all pages were assembled and copies of the complete catalog were sent to various departments in the plant.

One trouble with the old setup was the lack of uniformity between the inventory and the materials standard book. To keep the book up to date, individual pages had to be corrected, reproduced, and distributed for insertion. Too, no activity and cost data appeared in the catalog. This information was available, but the engineer had to go to extra trouble to get it.

The Meter Division stocks some 6000 items of raw material, used to make about 1000 different relays and instruments. Information on materials—size, description, specification—appears on thousands of drawings. For example, brass strip may be specified as "2 of 1.000 x .0500 tk Brs 1523-1." This means that the brass is 2 in. long, 1 in. wide, and 0.05 in. thick; specification number is 1523-1. In the superseded book, an item of material was designated on a drawing by its description and specification number (7601-12 in the example). To adapt the book to tab machines, the plant had to develop a coding system that was more meaningful than this arbitrary account number.

New standard book . . .

A portion of a page from the new standard book is reproduced above. **Supplementing the description are the code identifying number and data on activity and cost.** The tab machine makes a multilith master (11 by 17 in.) that is reproduced on an offset press.

The new code, which supersedes the previous specification number, permits wide flexibility. Thus 13402-AA represents brass (134), cold-rolled strip (02), 70-30 copper (AA); 13402AB designates cold-rolled brass strip that is 80-20 copper.

The operating divisions add three suffix numerals, starting with 101, to identify each size of material that they stock. Code 13402AA 101 identifies a given thickness and width of brass with 70-30 copper; suffixes 102 to 999 identify other thicknesses and widths of this material. The three

IDENTIFICATION NUMBER	STK. CLASS	UNIT COST*	UNIT OF MEAS.	QUARTERLY ACTIVITY*	SEQUENCE NUMBER
					196
					197
					198
					199
					200
					201
					202
12002CA101		2900	LB	8000	203
12002CA102		8600	LB	11	204
12002CA103		8500	LB	15	205
12002CA104		4700	LB	20	206
12002CA105		5000	LB	5000	207
12002CA106		7160	LB	203	208

control

suffix numerals are considered adequate, for the possibility that the plant will stock more than 899 sizes of a given material is remote.

This ten-character code, then, adapts each kind and size of each material to tab processing. It also identifies a given stock item throughout all manufacturing processes. The result is improved communication in internal operations.

The new system, illustrated above, shows the descriptive heading, the basic code specification, and the sequence line number in the first line or header card. The header cards for each material are duplicated by the tab machine and later sorted by it and run off to make the alphabetical index for the book. Other lines giving additional information and the example designation (Ex Des) follow in order below the header card. The various sizes of material authorized for stock are then listed in progressive order of dimensions.

Now a new item cannot be purchased and stocked without a code number. This is assigned in the Standard Engineering Dept, which retains and controls the master deck of punched cards. When a new item is authorized for stock, a new punched card is added to the deck; when a stocked item is cancelled, its card is removed. New sequence line numbers are added each time the deck is run.

Cost and maintenance . . .

The new machine-tabbed book is cheaper to reproduce and maintain than the old. Former cost of typing and reproducing 400 pages of the 8 1/2 by 11-in. book in the required number of copies was $2800.

Here's the breakdown on costs for the tab-produced book: punched cards, $600; master sheets, $40; reproducing 400 masters, $200. Total cost is $840. Not included here are costs for operating the tab equipment; but an allowance of $100 for two hours' use would still leave the total cost far below the former one.

Maintaining the old book consisted of changing, reproducing, and distributing individual pages. These additions, cancellations, and other changes required an average of 200 page renewals a year, at a cost of $1400. The new book, issued periodically, incorporates any changes since the previous issue. An issue costs $40 for masters and $200 for reproduction, or $960 a year for four issues. Two hundred new punched cards add $20, and if use-of-equipment cost is included, the total of $1380 still favors the new method.

ALUMINUM

CLASS A STOCK

28

SHEET AND STRIP 7601-12

Density .098 lbs. per cu. in.

Aluminum — Soft

Will bend 180° Flat

Tolerance ±

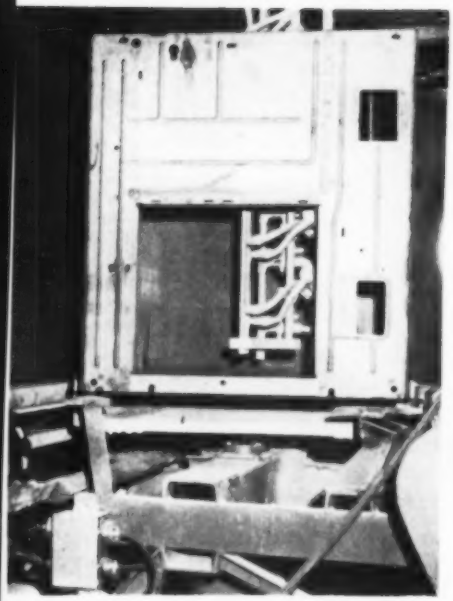
Tks.	Width	Lgth.	Tks.	Width	Wt. lbs. per sq.in.
.005	12.0	72	.001	.063	.0005
.010	12.0	72	.001	.063	.0010
.020	12.0	72	.0015	.063	.0020
.040	.875	72	.002	.032	.0040
.045	8.0	72	.002	.032	.0044

Ex. Des: 2 of .040 x .875 AL 7601-12

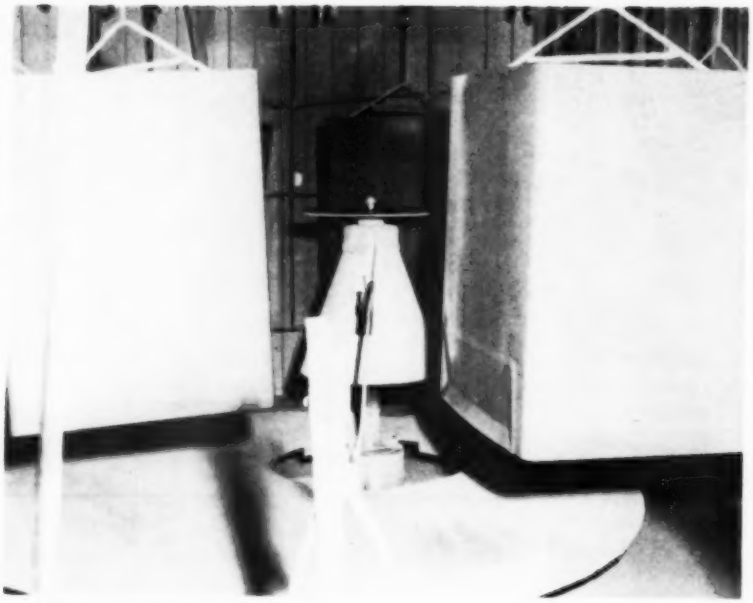
Ex. Des: 2 x 1 of .010 Tk. AL 7601-12

Old catalog page . . .

was relatively expensive to reproduce, hard to keep up to date. New machine-produced page (reproduced above) overcomes these problems, also includes cost and activity data



Coating the interior . . .
. . . is done by lowering a multiple spray gun into the interior as the cabinet rotates on a turntable, then slowly raising the gun to cabinet's full height



Applying exterior coating . . .
. . . is done in two identical spray booths (one for ground and one for finish coats). Job is done by a rotating disk Ransburg unit, which throws out electrostatically charged frit parts centrifugally. Charged particles cling to oppositely charged cabinet surface

Automatic spray all the way

By John Bauer
manufacturing engineer
Whirlpool Corp
Clyde, Ohio

Automatic spraying of frit mixtures for washing machines at Whirlpool's Clyde (Ohio) Division has not only eliminated bonderizing before coating but has cut down by eight the number of men needed to do the job.

Whirlpool's setup is electrostatic—a vertically reciprocating spinning disk applies exterior ground and finishing coats, eliminating bonderizing before the ground coat is applied (although cabinets must first be degreased). Coats were formerly all hand sprayed.

Conveyorized setup

Advance to this station is via a roller conveyor and onto a platform that slowly rotates about a vertical axis. When piece is located a multiple-nozzle gun is lowered into the cabinet, sprays the full inside height as the cabinet rotates.

Gun is removed and the cabinet moves by conveyor to an identical setup, which re-sprays the interior. These two operations produce a coat identical to former hand-spraying methods, but require eight fewer men for the job.

Next the cabinets are hung by swivel hooks to an overhead chain, pass through two identical circular booths (photo above right). In the first the exterior ground coat is applied, in the second a finishing coat of vitreous enamel. This is not done by spray gun but by Ransburg equipment which sprays water-mixed frits from a vertically reciprocating spinning disk.

Mixtures are held within close vis-

Close viscosity

cosity limits and are automatically fed to the top center of the disk. Centrifugal force throws the mixture outward in all directions from the disk's sharp edges in a continuous fine spray. The electrostatically charged disk imparts a similar charge to each particle so that the particle is attracted to the surface of the grounded cabinet, which is of opposite polarity.

Advantage of this method is that it eliminates almost all overspraying and insures that the finish adheres uniformly to the entire outer surface of the cabinet.

In passing through the circular booths, the chain conveyor carries the cabinets through almost a full circle. During transit each cabinet rotates slowly about its own vertical axis.

Some water evaporates (without heating) as the ground coat is applied in the first booth, before the cabinet reaches the second booth, where the finishing coat is applied. Further drying is done in an oven before the cabinets enter the high-temperature enameling furnace, where the coated cabinets reach a red heat that fuses the frit, causing it to adhere firmly to all surfaces.

Resistant finish

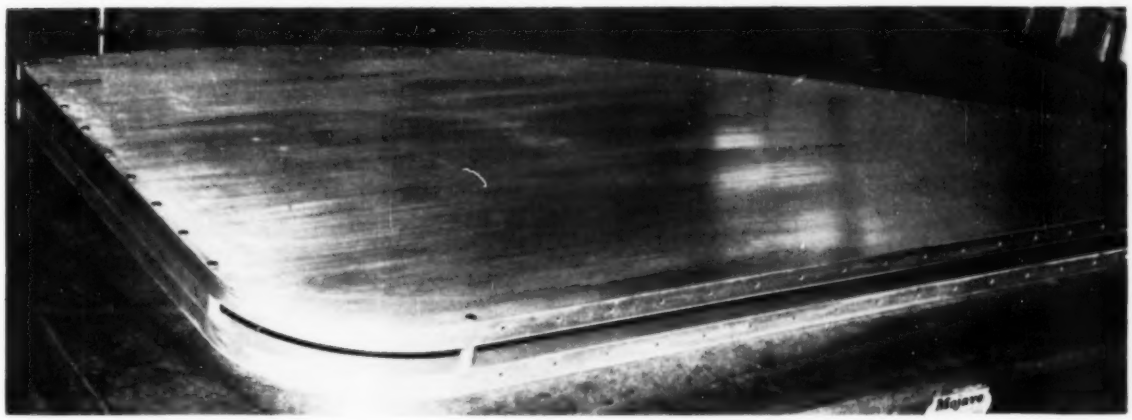
A slow cooling follows and the resulting finish is in reality a highly-resistant-to-deterioration glass coating. Application of this type of finish by the Ransburg method, a new departure for Whirlpool, marks one of the first uses of such equipment for vitreous enameling.

Quick but strict methods build pillbox antennas

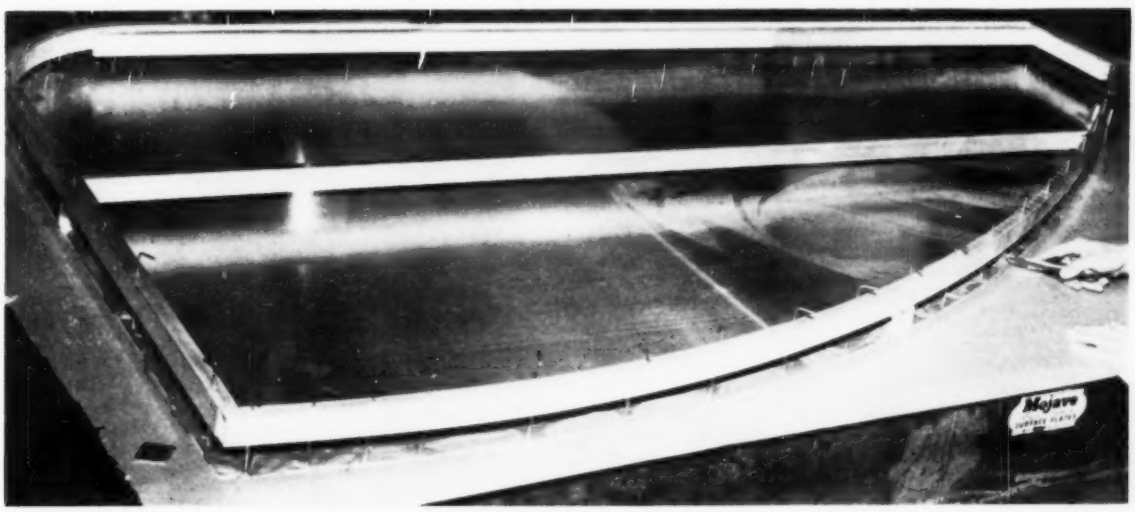
By Robert W Johnson and Stuart H. Hahn,
Electronic Defense Laboratory, Sylvania Electric Products, Mountain View, Calif

Sheet metal, box sections, and honeycomb — all aluminum — are combined in microwave antennas built with several unusual techniques by Sylvania. The antennas are large, flat structures, normally mounted vertically, with a central slot between two thick walls, and with a curved parabolic back contour. Small lots make speed and simplicity essential in the shop, but precision requirements make positive fixturing equally important.

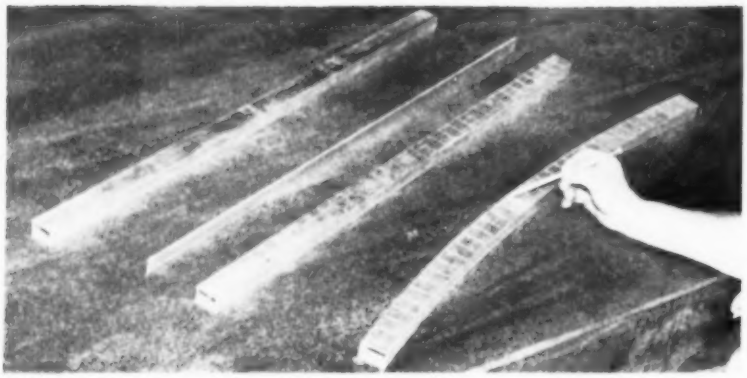
One lot consisted of four antennas like the one illustrated. Dimensions are roughly 8 x 4½ ft, including two side panels for each unit made by sandwiching 1½-in. aluminum honeycomb between 0.08-in. aluminum skins (6061-T6 alloy). The sandwich edges are closed by hollow aluminum rectangular bars—or tubes—which were easy enough to assemble on the straight sides, but a bit of a problem at the curves. These had to be formed to within ± 0.02 in. of design curve over the entire length of 9 ft. They could not be roll-formed because the process would distort the cross-section of the bars, and because the varying curve could not be formed to the required accuracy.



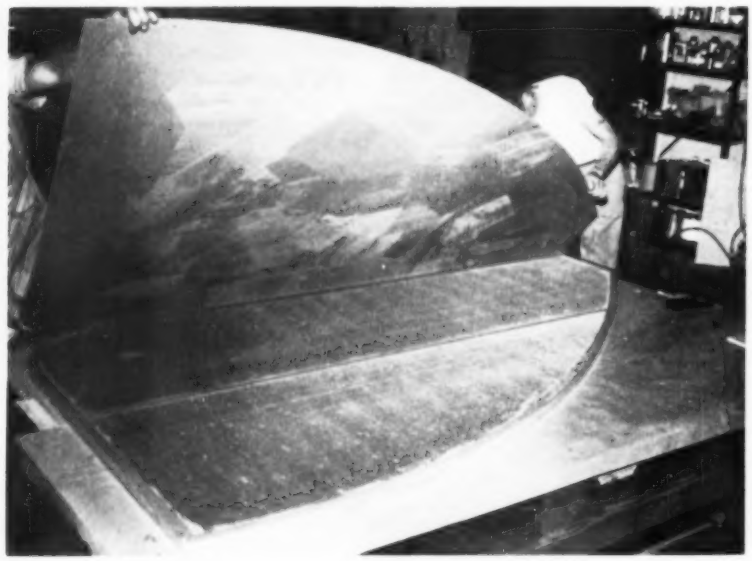
Finished pillbox . . .
Slot opening between two walls admits microwave signals, or emits them if the antenna is attached to a transmitting set



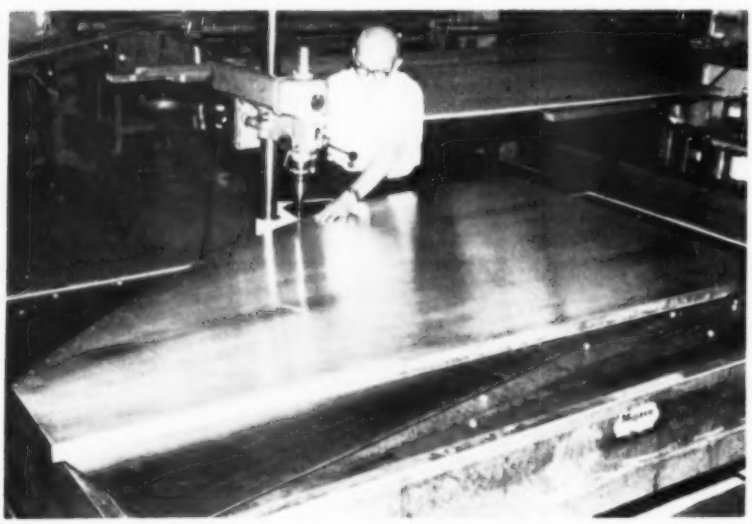
Basic wall parts . . .
Rectangular tubing is assembled on blocks, then bonded to aluminum sheet underneath. Central tube is simply a stiffener



Cut-bend-bond . . .
Tubing is sawed nearly through, then bent to match templet. Auxiliary strip is bonded to open-cut edge of tubing to hold contour and prevent springback



Final bond . . .
Honeycomb is cut, fitted into the frame; and then saw cuts in tubing and slight mis-match holes (between honeycomb and tubing) are filled with adhesive before top sheet is added



Flexible drill table . . .
Stone surface plate is topped with glass marbles, protective steel sheet, and bonded assembly so through holes for bolts can be drilled

A trick from cabinetmaking solved the problem. Each curve was made by cutting parallel slots almost through the tube at regular intervals along the length to be curved. The tube was then bent to match a fabricated templet, and fixed in that curve by bonding a strip of aluminum along the curve, across the open ends of the sawed slots.

The templet was laid out with a Parabolameter—a precision scribing device that has only one adjustment to set the focal length of the curve. The metallic templet was sawed, then filed within 0.005 in. of layout.

All joints were bonded with an epoxy adhesive filled with aluminum powder. Panel parts were kept in alignment by angle-bent dowel pins of steel. These were removed after the plastic bond was partly cured at room temperature.

Assembly was completed on a stone slab, over which a blanket sheet of vinyl was sealed, then air removed from inside with a vacuum pump. Complete curing takes place at room temperature with the vinyl sheet applying atmospheric clamping force on each panel. Some 90% of ultimate bond strength is reached in 12 to 24 hr—maximum strength is reached in a week or more, but 90% is enough to allow handling the panels. Ultimate shear-tensile strength of the adhesive is 3000 psi with room-temperature cure.

Machining on the Slab . . .

To prevent mechanical damage to the panels, hundreds of holes were drilled with the work still on the slab, but supported by a sheet of steel over marbles—to clear the drill. The 140-lb panels were easily positioned under a drillpress located at one edge of the slab. A curb of taped-on metal strips prevented the marbles from rolling off the slab.

Mechanical clamping for the final twin-panel assemblies was done with socket-head through bolts and Allen-nuts, entered through Dot spring-type chassis plugs. Parallel assembly and right-angle drilling was assured by operations on the stone slab.

Specify end physical properties...

Get greater fastener economy

In no other single industry do standards play such a dominant role as in the fastener industry. "Of necessity, fastener manufacturers must be, and are, standards-minded. They realize full well the need for, and the value of, standards, and, in fact, their own high dependency on standards," said Richard B Belford, technical advisor, Industrial Fastener Institute, at the ASA's Tenth National Conference on Standards, held recently in Detroit.

Specify end properties

"When selecting a fastener for use in a certain application, the user is interested in knowing just one thing —will it do the job for which it is intended? The best assurance that it will," continued Mr Belford, "is a specification based strictly on the end properties of the finished product." Inclusion of restrictive controls, such as dictation of material or method of manufacture, limits the number of qualified manufacturers and increases production costs.

Specify end properties of the finished product; leave decisions as to specific choice of material analysis, production method, and subsequent treatments to the manufacturer. This approach will assure the consumer maximum economy without sacrifice of quality or service dependability.

Here are a few examples to back up these points. Say you want a steel bolt meeting SAE Grade 0 specifications. Very few fastener manufacturers make a complete line of all fasteners through the entire size range. One manufacturer, predominantly strong in rivets, will probably have a good stock of 1008 steel; one strong in the machine screw field may have 1015 steel available. Either grade meets the specification of SAE Grade 0. Thus it would be unnecessarily confining from a price and delivery standpoint to ask for parts to be made from only one grade, say, SAE 1010 steel.

In a similar case, SAE Grade 5 may be made from SAE 1030, 1035, 1041, or several other steels, depending on size and method of manufacture. Fasteners can be cold headed from one grade or hot headed from another and, with suitable heat treatment, meet the physical property requirements of the specifications. Both of these examples are from a paper presented by H L Hopkins, chief engineer, The National Screw & Manufacturing Co.

Nut standards

This is one of the most active fields in fastener standardization at the present time, said Robert L Riley, assistant general manager, Bethlehem Steel Co, Lebanon, Penna, who then pointed out what he considers the most important developments to come:

- Establishment of an optimum nut testing method
- Development of nut data, based on research, explaining load distribution and nut behavior under various stress conditions
- Elimination of the regular nut series
- Consideration of renaming heavy and finished hex nut series
- Further simplification of nut styles

The first two points are under study at the Industrial Fastener Institute, and reports are due in 1960.

The regular nut series should be eliminated. Quite a few years ago the ASA approved a finished hex nut series which was to replace both the old light and regular nut series. Despite the strong swing over to the finished hex nut, the regular series has been included in all subsequent American Standards with the notation, "one-fourth to five-eighth inch sizes not recommended for new designs." The IFI will exert pressure for dropping the regular series entirely.

Why "finished"?

This would leave only two series of nuts, the finished and the heavy. The term "finished" has always been confusing; it implies a degree of surface finish that is not required. It was adopted to differentiate from the more liberally toleranced regular nuts, but since the regular series is about to disappear, the need for "finished" no longer exists.

"While I have such a splendid opportunity," said Mr Riley, "I am going to take the liberty of suggesting that we might call the new finished series a thin-wall nut and the old heavy series a thick-wall nut."

Since simplification is a vital part of standardization, why not limit standard nuts in the size range ¼ to ⅝ in. to two series, thin-wall and thick-wall, but to only one style, double chamfered? The advantage of a double chamfer over a washer face to the user is obvious, and since practically all nuts in this size range are made on nutformers, there should be no difficulties from the manufacturers' point of view.

High-strength bolts

"Although high-strength bolts have been used in the automotive industry since shortly after World War I, their use in buildings and bridges was a novelty in 1951," said Edward R Estes, Jr, research engineer, American Institute of Steel Construction, Inc. Since the first application of these bolts in the construction industry, however, there has been a phenomenal increase in their use in this country, to the point where, today, high-strength bolts have almost completely replaced rivets in structural connections.

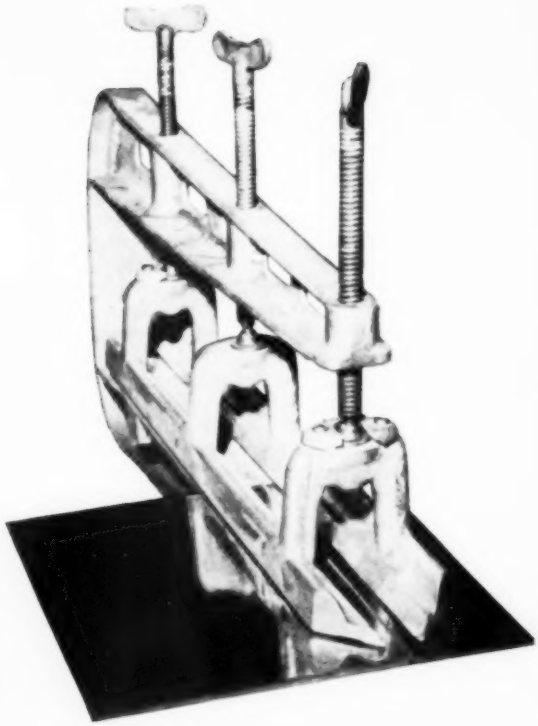
Studies are now underway investigating the feasibility of using high-strength bolts for shop-fabricated connections. "It may be," said Mr Estes, "that in another eight years the rivet will be as much of a rarity in the shop as it is today in the field."

Bolt standards

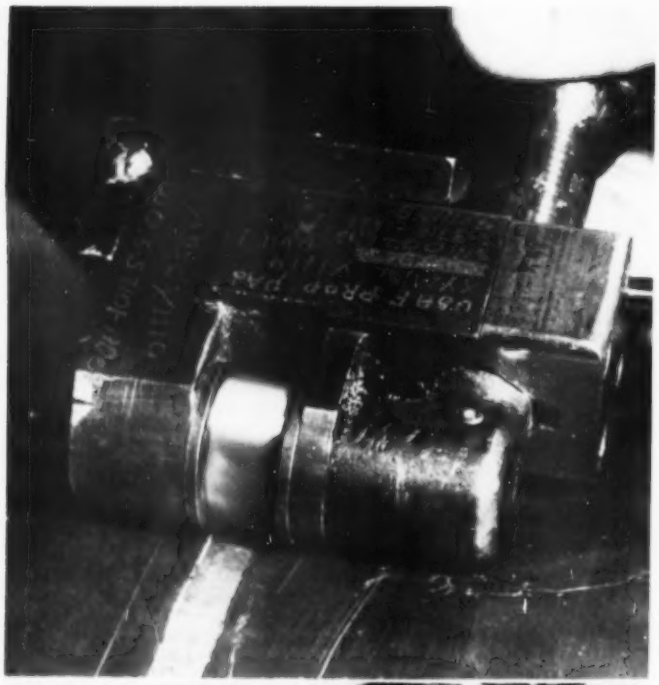
The foremost development in bolt standards, reported W G Waltermire chief product engineer, The Lamson & Sessions Co, is a proposal to establish a hexagon-head bolt with the lower height, or thickness, of the regular hex head, but with the width of the present heavy-head series. As compared to the regular-head series, this would provide an increase in bearing area ranging from 64% on a ½-in. size to 25% on a 1¼-in. size.

Another change that would benefit the national economy would be the replacement in our standards of square-head bolts and nuts by hex-head bolts and nuts. As compared to a square shape of the same across-flats dimension, the hex shape decreases the diameter of the driving socket and, hence, the flange width needed to clear the socket. In addition, a hex shape is more economical to manufacture in modern, high-speed bolt-headers and nutformers.

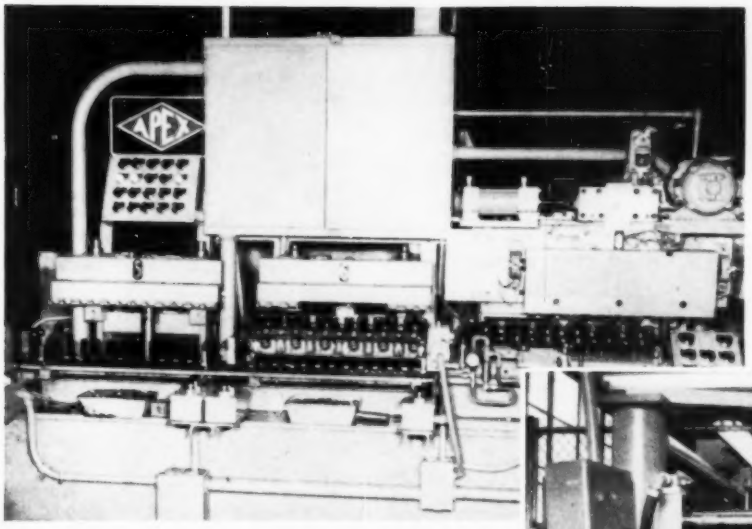
Shop Shots



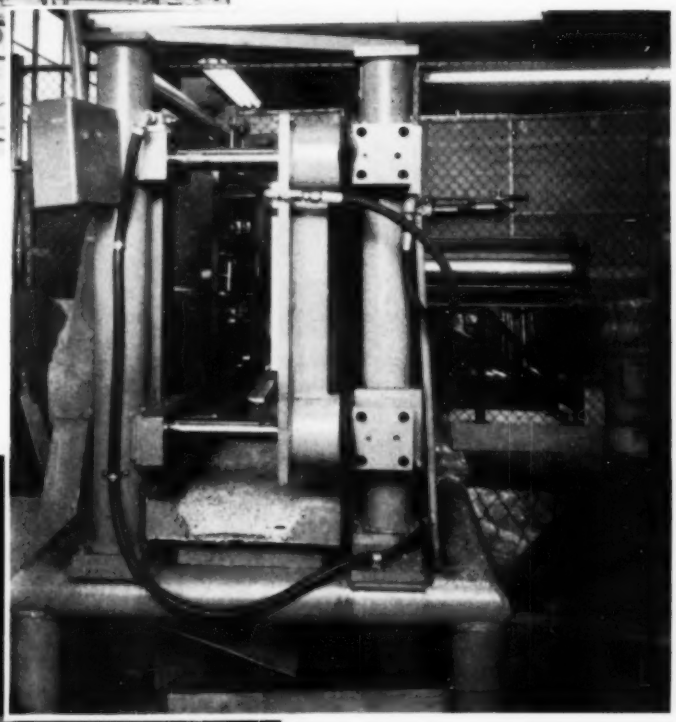
Portable chill-bar press . . .
Metal sheets are butt-welded in the field with a 24-in. lightweight aluminum clamp fitted with a detachable base and two aluminum chill bars. Three screws clamp the sheets under either 26-in. or 12-in. bars, which are replaceable. The 30-lb unit, developed by Melcher Mfg. Co, Spokane, is designed for out-of-shop installations of drain boards, sinks, and such equipment



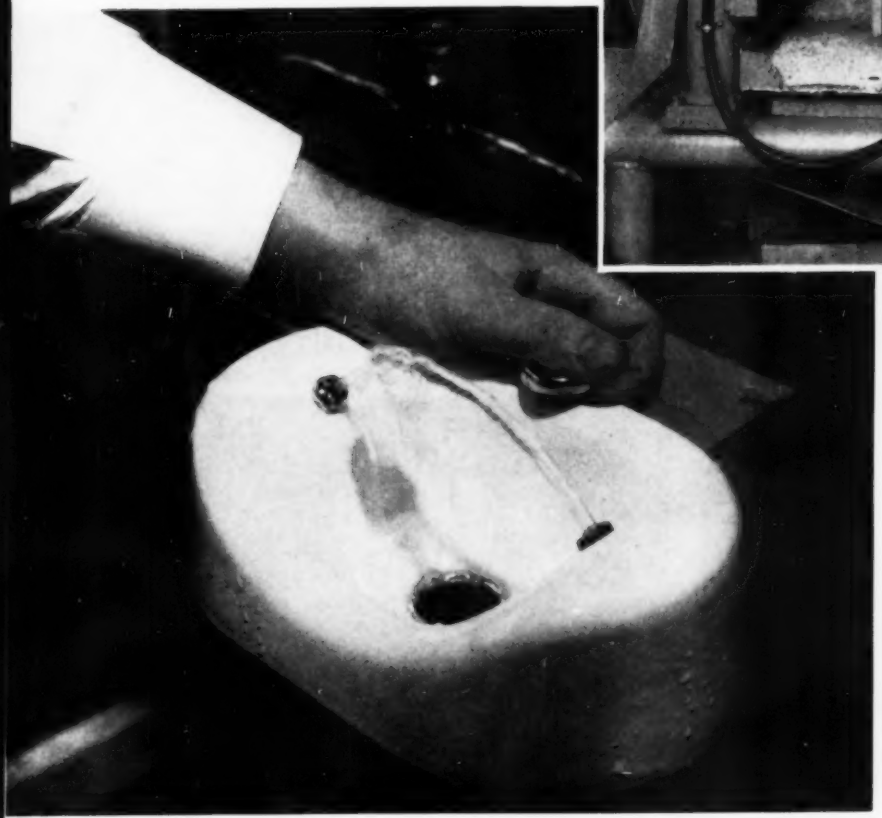
Weld-bead shaver . . .
Hand-held, air-powered shaving tool trims weld beads on fuel tanks for Bomarc interceptor missile. Cutter is double-cut HSS tool with 11 tpi; aluminum is cut with a 45° helix six-flute cutter. Either cutter rides between two rollers that control depth of cut. Bead is removed to reduce notch effect, improve aerodynamic smoothness, and to simplify X-ray inspection. Tool speed is 12,000 rpm. Designed by Boeing Airplane Co, the tool saves up to 36 man-hr per fuel tank



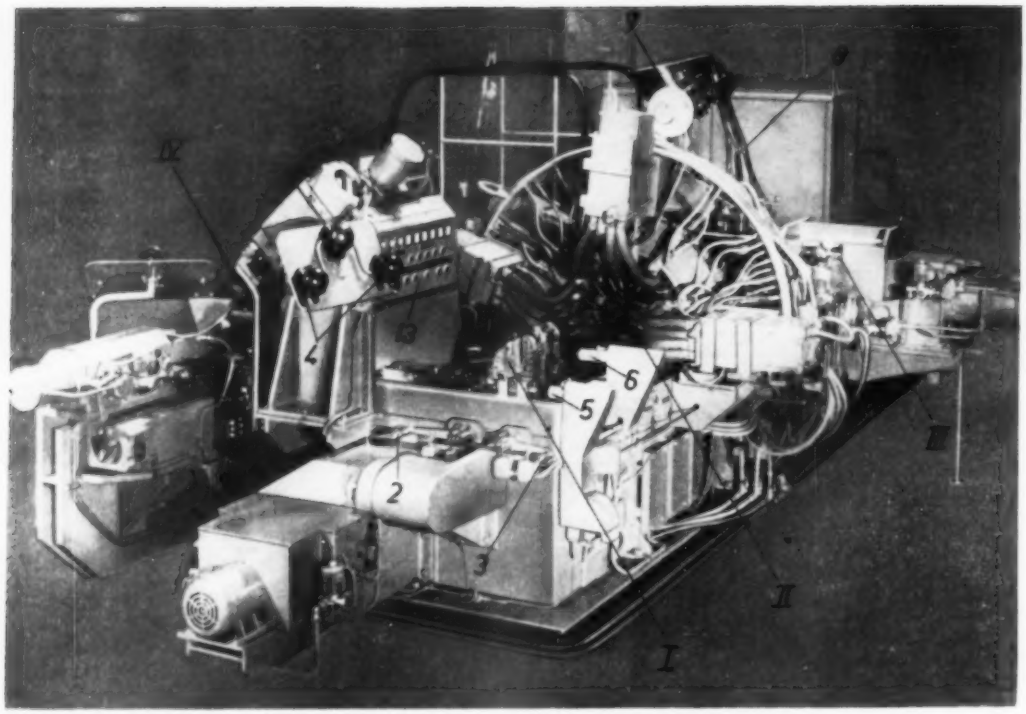
Inline valve assembly . . .
Transfer machine seats valves and adds springs, keepers, retainers, and washers to Ford Falcon cylinder heads. Apex machine is a low-volume unit, even though automatic. Newer Falcon engine line will have faster rotary indexing assembly machine



Chain drives multiple spindles . . .
Drills and countersinks cut holes in access doors for Convair 880 airliners at a special chain-driver H & B American machine. Any pattern can be arranged with up to 80 holes to tolerances of ±0.005 in. Platen is air-powered to grip the work. Fluid clutch absorbs shock from 15-hp motor to prevent chain break



Pure eyewash . . .
Double-spray water fountains at Timken Roller Bearing Co are part of an eye-protection program. Button under the thumb can be pressed by a forehead to open the valve and wash harmful chemicals out of the eyes



Four-station welder turns out assemblies with two operators instead of six

40-sec merry-go-round welds heaters for Opel

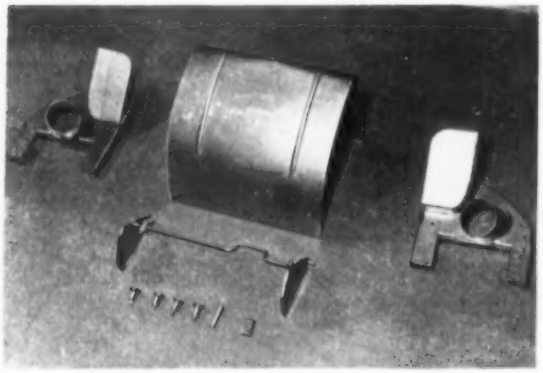
An automatic resistance-welding and transfer machine has hiked the output of heater distribution chambers to 600 per shift at the Adam Opel Works, GM's German subsidiary at Russelsheim. Management won't say what the output used to be, but manpower for the job has been cut from six to two.

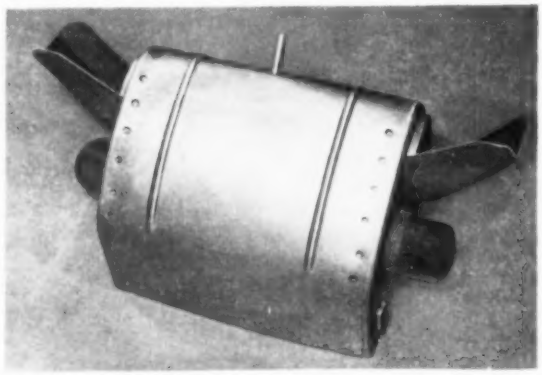
And the main duty of the two operators is simply to load parts. The machine—designed and built by the welding division of Voigt & Haeffner (Frankfort/Main) — does the rest. It automatically moves the assembly through four stations where it welds the end pieces to the body and then welds on four studs, a threaded plate, and a drain tube.

The control circuitry is laid out so that the completion of one phase of the operation automatically triggers the next phase. However, the master control panel can also control individual phases of the operation for test runs and other special purposes.

One operator works at Station I placing the major components on the holding fixture. First is the flap subassembly: two sheet-metal stampings on a common tie rod.

Then he positions the end pieces.





Before and after . . .
These parts and subassemblies must be loaded manually, but the machine performs all welding operations to produce heater distribution chamber (right)

Each of these subassemblies consists of a chamber end plus a baffle plate and a pipe connection, all spotwelded together in a previous operation.

Finally, he installs the stamped, sheet-metal chamber body. Then he locks all the parts securely in place by depressing two levers (2 and 3) and starts the fixture on its journey through the machine by pressing the mushroom-headed controls (4).

At this point, an air cylinder withdraws the two locking bars (5 and 6) that hold the fixture stationary during loading. It also engages a clutch that sets the transfer chain in motion.

Then, as the loaded fixture moves off in the direction of Station II, the operator raises the two levers (2 and 3) to let the next fixture move into the loading position.

At Station II, each end of the chamber is spotwelded to the chamber body at 20 points. For this purpose, the fixture is successively located and locked in three different positions.

In the first position, the machine makes 12 spotwelds on the right-hand end. In the second, it makes the same 12 spots on the left-hand end and, at the same time, makes the final 8 welds on the right. Then, in the third position, it finishes up on the left.

Loads studs automatically

At Station III, four drop-forged studs are projection welded to the chamber body. Four tubes carry the studs, collar first, from the feed magazine to an automatically controlled slide at the bottom of each tube. There, the slides simultaneously feed four studs onto a horizontal plate where they are held securely by electromagnets.

Then an ingenious arrangement revolves the plate downward to the vertical position and pneumatically pushes it toward the front of the machine. At the end of the stroke the studs are positioned on the four welding electrodes, where they are held by springs.

At this point the electromagnets are turned off, and the plate backs away to return to its horizontal position. When the next fixture stops at Station III, the studs are automatically welded to the assembly. Then, as the fixture leaves the station, it trips a limit switch that starts the next stud-loading cycle.

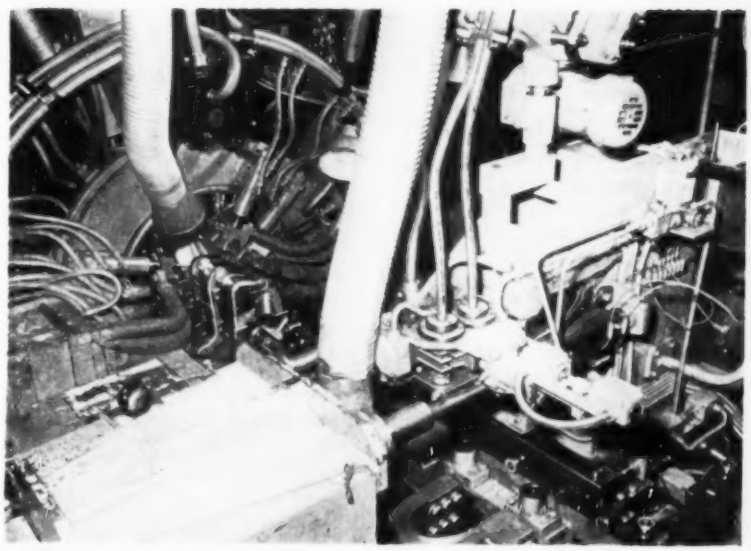
From Station III the fixture moves on to the end of the transfer chain. There it changes direction 90° and moves to the rear of the machine where it again turns and moves along the back until it is stopped at Station IV.

While the fixture was passing through the other three stations, the operator at Station IV was positioning a threaded plate and a small length of drain-off tube on their respective electrodes. The moment the fixture stops and is locked in position at this station, the electrodes advance and spotweld the two parts to the assembly.

The finished chamber is next released from the fixture clamps, and an ejector raises it enough so that the operator can pick it up. He loads it onto a belt conveyor running parallel to the machine and presses the control buttons to route the fixture on to the loading station.

However, the fixture will not move from Station IV until the one being loaded in Station I starts on its way around the machine. The time taken from loading the subassemblies at Station I to removing the finished chamber at Station IV is 40 seconds.

Operator loads fixture at Station I . . .
Assembly then moves to Station II (under cable bridge) for 40 spotwelds



Machine makes 8 spotwelds . . .
in third position of Station II (rear). Then the assembly will move to Station III (under the feed tubes) to receive 4 studs, then around to back of machine for final operation

Turret tool does economic cold heading

By Ben C Brosheer, associate editor

Cold working is considered desirable when sealing ledges are formed into covers for truck and car automatic transmissions. The illustrated clever tooling on a No. 1-F Fastermatic turret lathe does the job for Borg & Beck div, Borg Warner Corp, at lower cost than press dies.

A hardened roller is driven by the turret cylinder into the outer edge of the steel transmission cover to form the ledge, then excess stock is removed by facing tools later in the turret-lathe cycle. This makes it a fast operation without investment in die development and construction, which would be prohibitive for the small lots in which these SAE 1015 stampings are produced

The roller has a 1-in. face and 4-in. diameter, hardened to 60-62 Rc. The roll support has a keyway that lines up with the spindle axis so the roll can be adjusted radially after it is attached to a turret face. This insures tangent alignment of the roll with the circle of contact and prevents any skewing action that would cut instead of cold-roll the work.

Rolling is one of five turret operations, handled by an operator that also supervises adjacent machines that turn the center cap in the outer face of the cover and drill and tap two Dryseal pipe-tap holes.

Peripheral speed for the rolling operation is 425 fpm at the point of contact, maintained also for a number of other covers of different size.

The roll can be reversed in its support bearings so the second edge can be applied after the first dulls.

Finishing tools for the edge seals and all other tools for machining the inner face of the transmission cover are mist cooled. A spring-loaded nozzle on the spindle head enters a block below the turret-guide bushing to supply coolant to a manifold on the turret when the tools are cutting.

Rolling tool . . .
Hardened HSS roller is mounted in ball bearings, can be reversed when one edge dulls. Socket-head capscrew and slot allow adjustment of roll tangent to the diameter being formed

Rolling action . . .
Quarter-inch steel is rolled in 60 sec at 143 rpm. Positive stop halts the automatic cycle. 600 psi in the turret-feed cylinder provides pressure against the work

Rolled edge seals . . .
Truck-transmission cover is rolled with a turret-lathe tool, then machined to make a tight-sealing ledge around the OD

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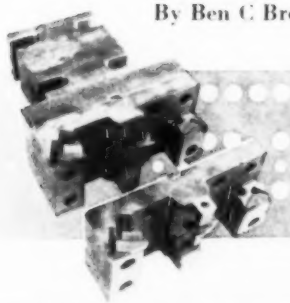
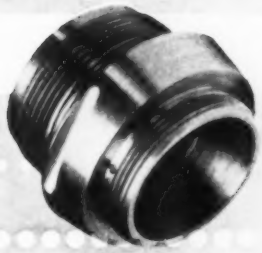
Numerical control...
Automatic tool change...
Automatic work transfer...
and good process planning...
show how to...

Lower short-run manufacturing costs

"... advantages of numerical control fall into four broad categories: reduction in time, more output per dollar, minimum scrap and much greater accuracy ... companies which do not take steps in this direction soon may well find their products priced out of the market ..." — Lt Gen C S Irvine, Deputy Chief of Staff, Materiel, U S Air Force

By Ben C Brosheer, associate editor





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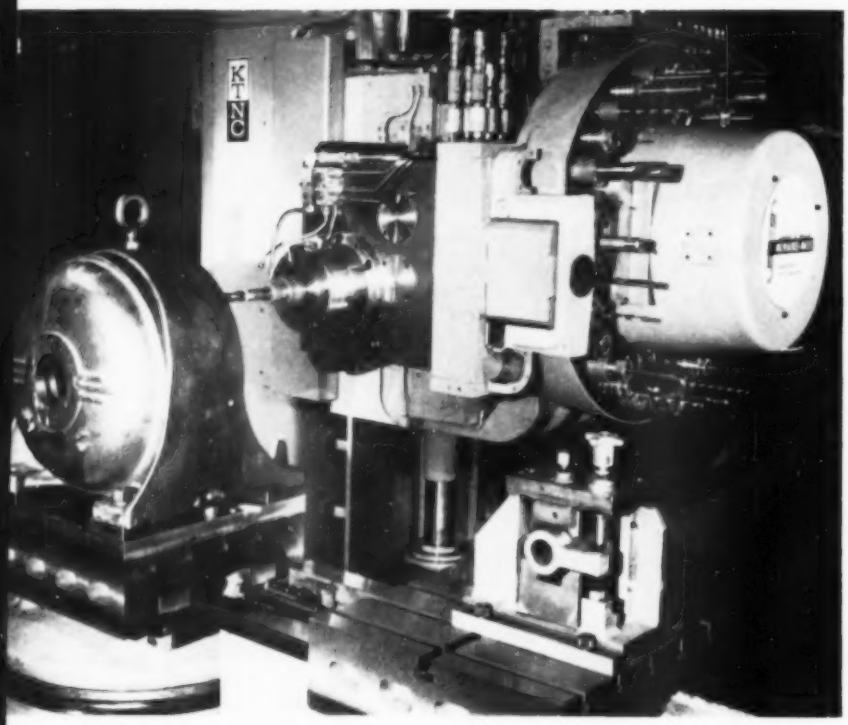
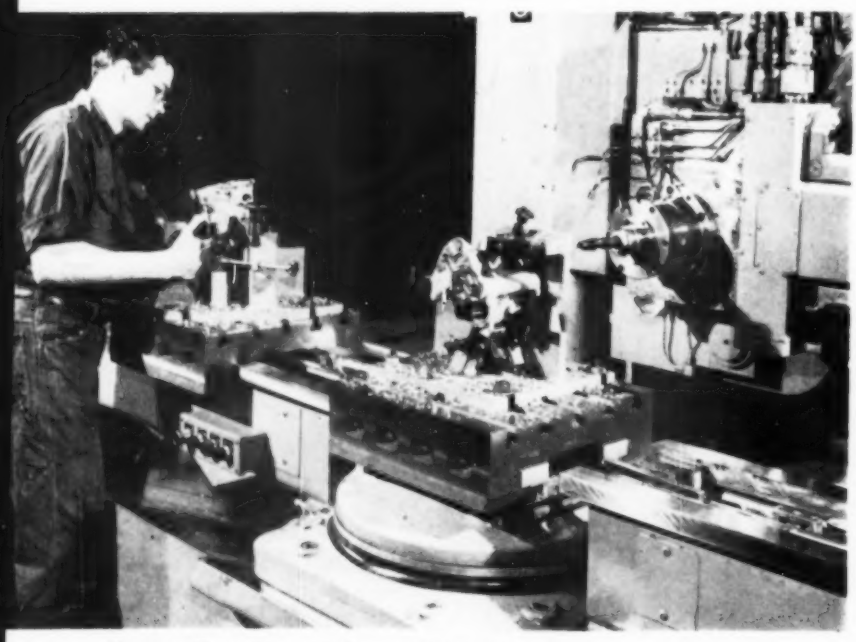
A new



Gear-reducer housing (left) . . .
was spot-drilled, drilled, reamed and tapped with 12 tools in test setup on Milwaukee-Matic at K&T plant. Five tools extend 13½ to 15 in. from spindel nose, so were changed manually, yet 18 holes inside the case were machined in only 25 min. Test was made without disturbing setup (right) for machining Milwaukee-Matic cartridges



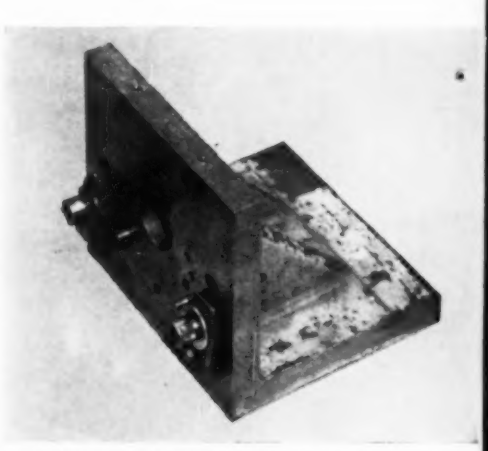
Floor-to-floor time can be cut 19 to 41% . . .
when machining Chandler Evans cast-aluminum fuel control system housings, covers and flanges on the Model H Milwaukee-Matic. Two parts are machined alternately in this setup

While the first-cost of machine tools equipped with numerical positioning controls still is high, in comparison with the more conventional machines they replace, their increased productivity plus their ability to machine small lots of parts to precision tolerances at much lower unit cost make their purchase an attractive investment to cost-conscious managements.

Even with manual control of some portions of the machine cycle, such as part loading and unloading, tool changing, etc, floor-to-floor time for a wide range of parts has been reduced 30 to 85% in plants using such machines for commercial production operations on job lots of one to 10 or 12 parts each (AM—Sep 8 '58, p93; Nov 3 '58, p92; May 4, '59, p102).

Metalworking cost analysts also are discovering other advantages made possible by installing numerically programmed machine tools using discrete systems:

- **Programming of control tapes** or punched cards can be accomplished with relatively inexpensive equipment by process engineers familiar with the characteristics of the machine and its controls — expensive computers and trained mathematicians are needed only when the machines have continuous-path control systems.
- **Machine utilization efficiencies are increased** almost automatically. Automatic control of all machine



$306 fixture (above) replaced three
jigs and fixtures (right) costing $1890 when job of machining CI plug-switch support brackets for K&T milling machines was

functions eliminates, or reduces drastically, human delays inherent in the operation of conventional machine tools—so metal is cut a greater portion of the overall cycle time.

• **Tooling costs generally can be slashed** drastically. Usually only simple locating and clamping devices are needed to position the parts in correct relation with the machine spindle. The high repetitive accuracy inherent in numerically controlled machine tools of adequate design make expensive jigs with hardened guide bushings unnecessary. And, because the numerically controlled machine commonly does the quantity of work normally assigned to several conventional machines, only one fixture, if any, is needed in place of several. Frequently, savings in tooling costs are an important factor in rapid amortization of the installation cost of numerically controlled production machines.

• **Cutting tools last longer.** Precise centering of cutting tools in bushings, where they are needed, or the elimination of the bushings entirely results in minimizing damage to tool cutting edges, which seldom can be avoided when the machine spindle must be aligned manually with hardened guide bushings in a conventional jig. On one job, life of a set of 7 cutting tools was boosted from an average of 5 parts to more than 140 parts per regrind when the job was moved from a trunnion-supported jig at a radial drillpress to a punched-tape-controlled drilling machine.

• **Lead time can be reduced materially.** Whether the parts are of a new design—and tooling must be made, or the job is one that has been run before, on the numerically controlled unit it is not necessary to wait for weeks while complicated jigs and fixtures are designed, made and tested before the job can be started.

• **Engineering design changes cause fewer production headaches,** because it is easier—and takes less time—to reprogram a punched tape or a deck of punched cards than to change precision jigs and fixtures.

• **Floorspace for a given production line is reduced** because each numerically controlled machine performs a series of operations which, otherwise, would be assigned to a number of conventional machine tools. In addition, it is unnecessary to provide expensive floorspace at each machine for storing parts in process.

• **In-process inventory of partially machined parts can be eliminated,** or cut drastically, because smaller lots of parts can be scheduled as they actually are needed. Reductions in lead time needed to machine a production lot of parts also mean that a large inventory of parts in process no longer will be needed to insure continuity of operations on the assembly floor, or prompt service to customers who need repair parts, "spares," quickly. Capital previously tied up to maintain stocks of machined parts in the stockroom can be used to finance other operations—and taxes, depreciation and interest charges will be reduced.

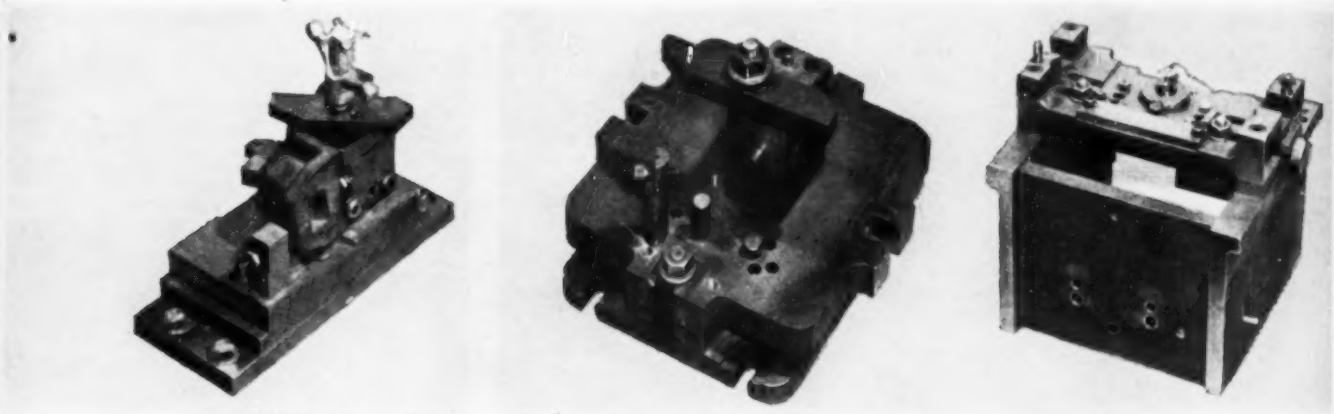
• **Tool storage costs can be cut** drastically. Tapes and/or punched cards can be stored safely in much smaller areas, with less cost, and with less danger of damage, than can expensive jigs and fixtures. (Goss Printing Press Co, Chicago, has 3000 jobs on tape stored in one file cabinet. This replaces many thousand sq ft of tool-storage area.)

• **Setup flexibility almost always is increased** with properly designed machine tools using numerical controls. Interchanging tapes or decks of punched cards is accomplished easily—and changing work locating fixtures generally is simple. In fact, when tapes and locating fixtures are already on hand, it often is economically practical to change setups to run only one or two parts.

• **Scrap is practically eliminated.** With human errors removed by preprogramming, and checking the tape and the first piece, plus safety devices in the equipment, the danger of scrap-causing error is extremely low.

Indexable turrets shift tools

Need for rapid changing of cutting tools, with close control of the sequence in which they are used, has



moved from five conventional machines to a Milwaukee-Matic tape-controlled combination machine. Cycle time was cut from 0.64 to 0.28 hr

been recognized since the first multiple - operation machine was equipped with a numerical-control system. Maximum savings cannot be achieved if tool changing between cuts is under the control of the operator, not the machine.

Perhaps this is the reason why some of the earliest machine tools equipped with discrete-positioning numerical controls were types that normally incorporate multi-position tool turrets in their design.

To date, both punched tapes and punched cards have been used to numerically-control tool turrets of automatically cycled lathes, horizontal and vertical turret lathes, vertical boring and turning mills, and turret-type drilling machines. These arrangements have made possible the automatic interchange, usually in any required sequence, of as many tools as there are faces on the controlled turrets.

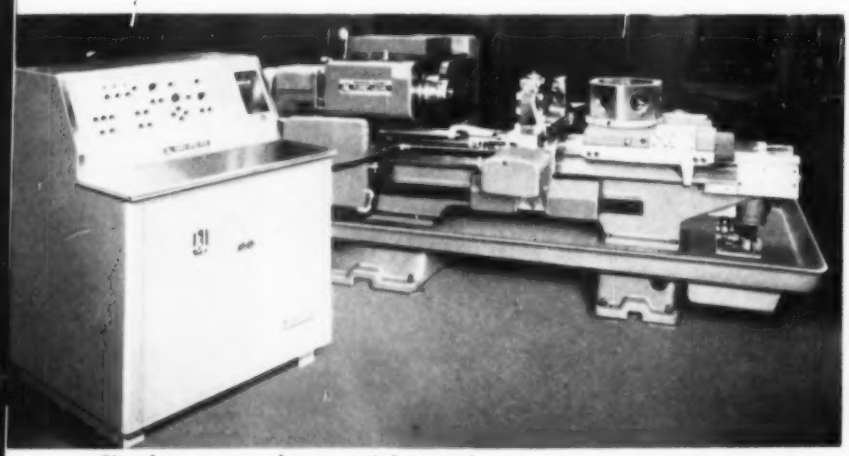
At the 1955 National Machine Tool Show, both Jones & Lamson Machine Co and Sundstrand Corp exhibited numerically controlled lathes which featured automatic tool-turret indexing. And a Wiedemann turret punch for piercing holes of various sizes and shapes in sheet steel panels (*AM*—Aug 1 '55, p102), exhibited in the same NMTBA show, was arranged with automatic control of both the punch-and-die turrets and the work-supporting table with either punched-tape or punched card discrete-positioning numerical-control systems. All three of these machines, although designs have been updated, still offer good cost-cutting possibilities.

The J&L turret lathe (*AM*—Aug 1 '55, p106; Aug 29 '55, p171) was designed for short-run flexibility. Of the same size and capacity as a standard No. 7A J&L turret lathe, this machine was controlled entirely from a 5-in.-wide, 32-channel punched tape, which easily could be punched manually with a simple desk-top tool. Control system was developed by The Barnes Engineering Co. An independent motor controlled by the tape indexed the 6-position tool turret at any position along the bed, through a geneva motion. Jones & Lamson now assembles its own numerical control systems, and recently sold two punched tape-controlled automatic production lathes to a west-coast aircraft manufacturer. However, the newly designed turret lathe operates from standard one-inch-wide, eight-channel perforated tape.

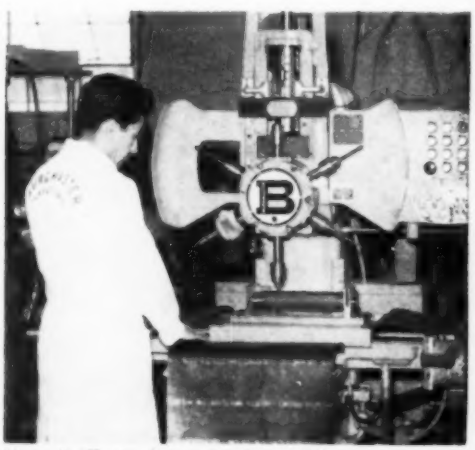
Punched cards, which can be programmed and hand punched quickly in the methods-engineering office, control the Model 14 Sundstrand automatic lathe for step turning shafts economically in small job lots (*AM*—Aug 29 '55, p172; Dec 3 '56, p128; May 4 '59, p102). This machine has a 2-position tool turret so roughing and finishing cuts may be taken automatically with separate single-point bits. The toolholder is indexed 180° by card control to change tools between roughing and finishing cuts, and to reset the tool turret for the next roughing cut. The prototype lathe, which uses a General Electric control system, is used today in the Sundstrand plant and has proved repeatedly that it can step-turn steel shafts in lots of from 1 to 10 or 12 pieces at production rates that beat tracer lathe floor-to-floor time by from 30 to more than 85%. Shaft diameters regularly are finish turned to within 0.0005 in. of specified size.

Six standard 1-in.-square turning and necking tools, which can employ throwaway HSS or carbide bits, extend radially from the 8½-in. OD, 2¾-in. high round turret on the cross slide of the numerically-controlled engine lathe recently announced by Cincinnati Lathe and Tool Co (*AM*—Oct 19 '59, p136). These tools can be indexed into cutting position in any desired sequence, and can be used to turn in either direction. This arrangement permits the use of a minimum number of tools to machine an almost unlimited variety of stepped shafts and similar parts with a mininmum loss of production time for changing setups.

Designed from the ground up as a numerically controlled lathe, this machine has no manual controls. Speeds, feeds and tool position changes all are controlled electronically or hydraulically from a standard 1-in.-wide, 8-channel punched tape in the reader of the Acramatic control cabinet, a unit perfect for machine tool control by The Cincinnati Milling Machine Co. Once the tape is put into the control cabinet and the cycle started, the operator is freed of all responsibility for the machining operation, and can work at other machines. Selection of feeds and speeds, selection of tool sequence, positioning of the tools, length and depth of each cut, and direction of each cut all are per-



Simultaneous and sequential control . . . of all functions, including indexing of the tool turret, was accomplished automatically on this J&L No. 7A-2½-NC turret lathe with manually punched tape

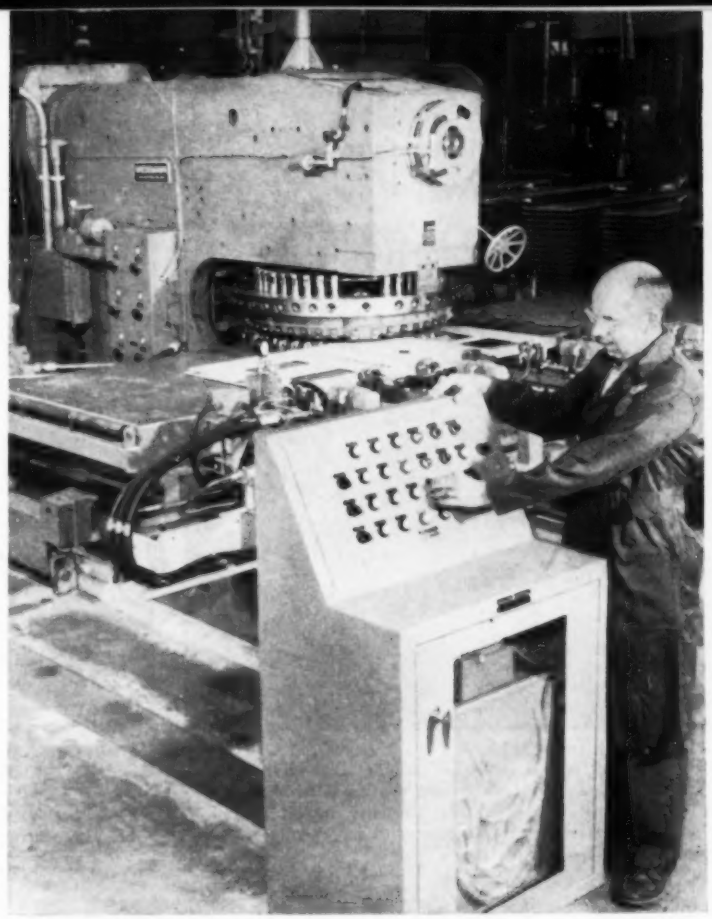


Six-spindle tool turret plus table of this automatic Burgmaster drill press are controlled with a punched 8-channel tape

formed automatically as directed by data punched into the tape. Close tolerances can be held without difficulty.

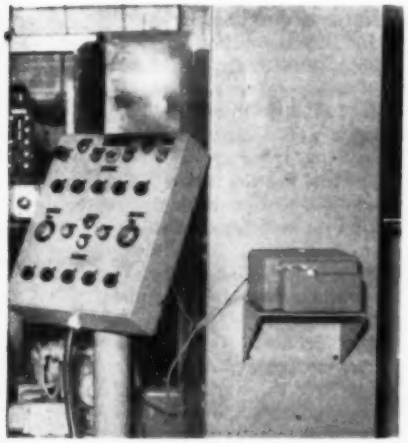
Indexing of five-position tool turrets, and traversing their supporting rams and saddles at feed and rapid-traverse rates, is tape controlled along with other machine functions on a Kaukauna vertical boring and turning mill announced early this year by Giddings & Lewis Machine Tool Co.

Because it was developed to machine large oil-field valve bodies to accurate contours, the 54-in. G&L vertical boring and turning mill (*AM* —Mar 9 '59, p146) employs a G&L Numeripath magnetic-tape numerical-control system. This system requires the use of a G&L Numericord director and a magnetic tape recorder for tape preparation operations, and a control console with a built-in tape playback unit at the machine. One Numericord director, designed and built by Concord Control Inc, Boston, and recorder can be used to prepare tapes for several magnetic-tape-controlled machines, as computing and tape recording are relatively rapid operations. Generally, one Numericord director can produce in 15 minutes enough tape to operate a machine for one hour.

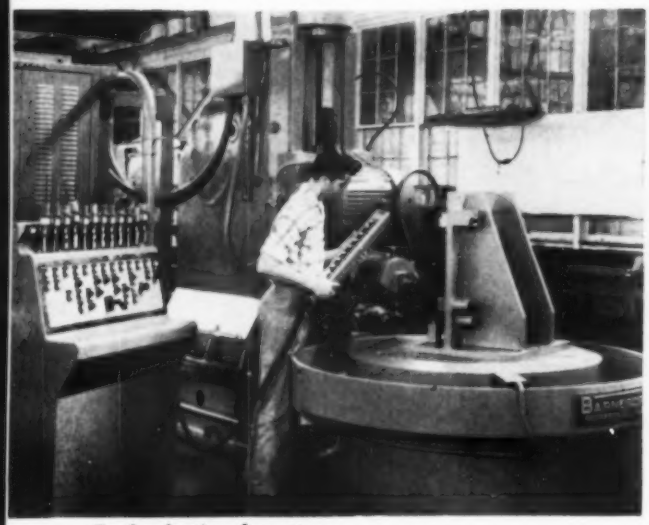


At 30 hits per minute . . .
Wiedematic turret punchpress completes an automatic sequence of locating and piercing holes in large metal sheet. Press operations are directed by modified General Electric Mark III numerical positioning controls from information programmed on standard 8-channel perforated tape. System controls hole location plus punch-and-die selection, the latter by indexing the turret

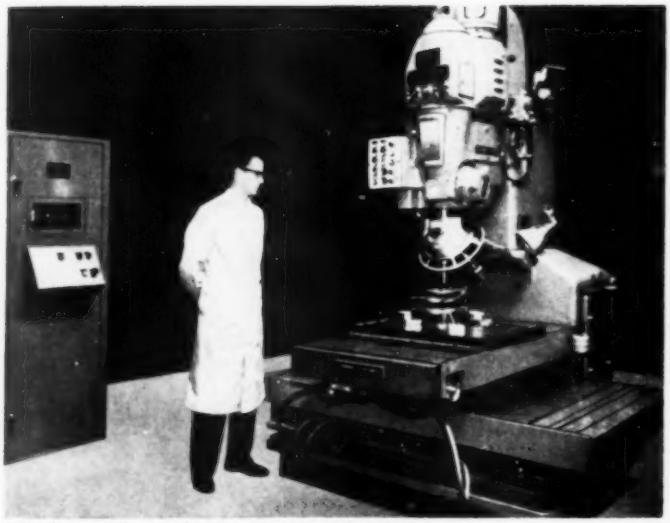
All operating functions are controlled . . .
from a perforated 8-channel tape on this 52-in. G&L-Kaukauna vertical turret lathe equipped with Numeripoint control system. Operations include indexing, positioning and feed rate of five-station tool turret on crossrail. Davis preset tool holders help speed setups on this machine



prepared in a Flexowriter typewriter. Spindles can be programmed in any required sequence



Tool selection from tape . . .
Indexing of work table and vertical positioning of spindle head, as well as horizontal feed of spindle, on this Barnesdrill semi-automatic drilling machine are controlled by punched 8-channel tape made in Flexowriter. Machine will not operate if tools are not used as specified by tape



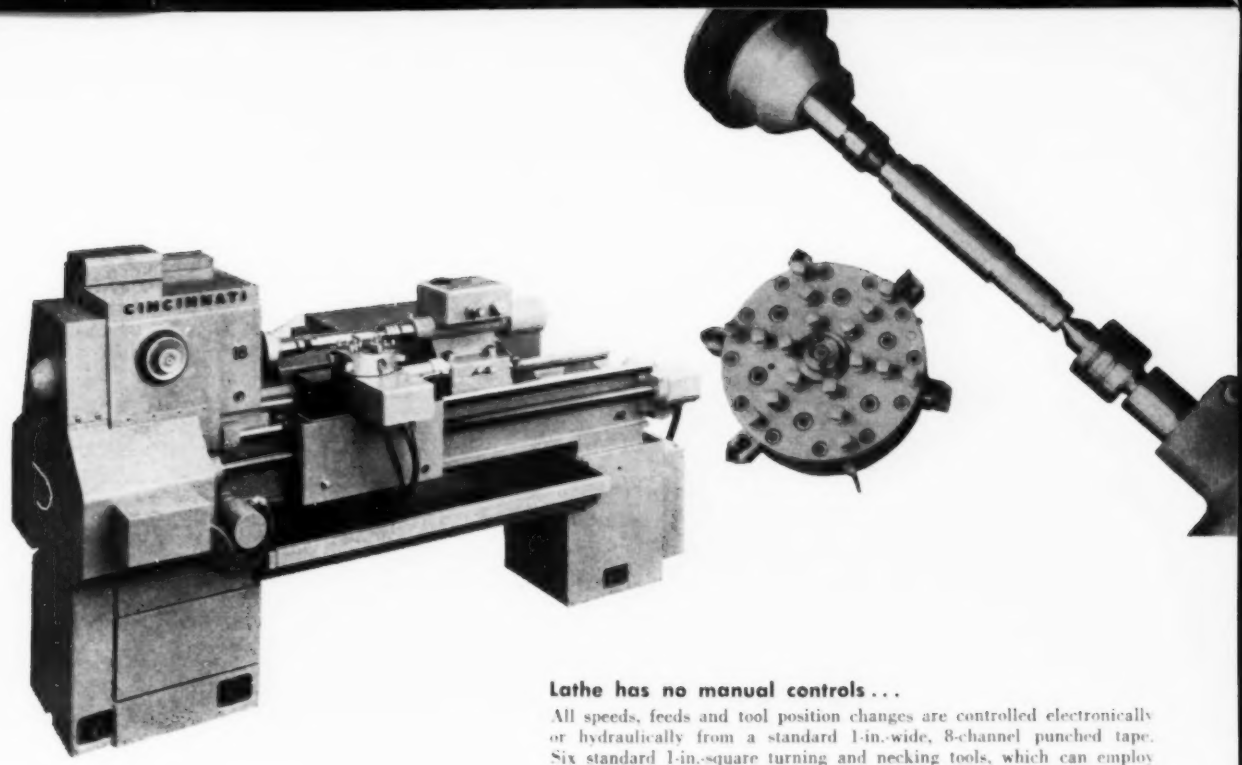
"Probomat" punched-tape control system . . .
developed by The Warner & Swasey Co directs this Brown & Sharpe Model B turret-drilling machine to automatically perform drilling, boring, reaming, tapping and similar operations in any necessary sequence

Limit switches . . .
under spring-loaded brackets are tied in with controls of Barnesdrill machine so machine will not function if manually-changed tools are not selected from console in sequence specified by punched tape

On the other hand, the 52-in. Kaukauna VTL was equipped with a G & L Numeripoint 8-channel punched-tape discrete (digital) positioning control system (*AM*—Mar 23 '59, p167) for complete control over all machine functions. Only a standard 8-channel Flexowriter typewriter is needed to prepare punched tapes from a process or methods engineer's program worksheets with this control system.

With either the Numeripath or the Numericord control system, G&L vertical turret lathes and boring mills easily can index and position cutting tools on turret faces in any required sequence. The operator need only observe the cut and the tool bits occasionally to make sure they are sharp and cutting properly.

Turret-type tool positioning on machines where the tools turn instead of the work also can be controlled with discrete numerical-control systems. A 6-spindle Model 2BHT punchedt-ape-controlled drilling machine (*AM*—Dec 1 '58, p144) developed by Burg Tool Mfg Co indexes its tool turret according to instructions punched in the tape with a Flexowriter typewriter or similar machine. Drilling, reaming, tapping, counterboring, countersinking, spotfacing and undercutting operations can be programmed within the ca-



Lathe has no manual controls . . .

All speeds, feeds and tool position changes are controlled electronically or hydraulically from a standard 1-in.-wide, 8-channel punched tape. Six standard 1-in.-square turning and necking tools, which can employ throwaway HSS or carbide bits, extend radially from round turret on cross-slide of this Cincinnati lathe designed for turning stepped shafts and similar parts

pacity of the machine and, depending on the tools placed in the six spindles of the turret, the spindles can be selected by the tape in any required sequence. Recently a similar 8-spindle Model 3 BHT machine equipped with a 30 x 45-in. positioning table and a General Electric punched-tape control system was announced.

Fully integrated, automatic work-positioning and machining also is possible with the Model B turret drilling machine marketed early this year by Brown & Sharpe's Turret Drilling Division (*AM*—July 27 '59, p30). This 6-spindle machine has capacity for drilling 1-in.-dia holes in steel with any of the spindles, and at any position on the machine table. It can be used with any standard numerical (punched-tape) control system. One of the first of these machines to be numerically controlled was equipped with a Stromberg-Carlson Model 202 point-positioning punched-tape system and a 28 x 32-in. Digimatic servo table. Others have employed the Warner & Swasey "Probomat" control system and larger tables.

Tool magazines increase range

Most exciting, in terms of cost-cutting possibilities for small and medium-size job-lot machining, of recent developments in the design of numerically-controlled machine tools is the use of a mechanism for automatically interchanging cutting tools between a drum-magazine and the machine spindle, in any sequence specified by data punched into the control tape or cards.

Several such methods have been developed during the past two years, and new ones already are on design boards of several prominent machine-tool builders. All of them, so far, involve the presetting of individual cutting tools in standard adjustable holders—generally with precision gages. This can, and usually should, be done in the toolroom, to insure that tools are set accurately.

Presetting tools for numerically controlled machine tools both simplifies the programming of the machine cycle, as cutting edges always are at a known distance from a common datum plane, and makes possible the same cost reductions preset tools have achieved for users of in-line and rotary-table transfer machine in mass production (*AM*—Feb 13 '56, p124). They simplify precise tool positioning, and almost always eliminate need for taking trial cuts to insure accuracy of set-ups. Scrap losses and inspection costs therefore can be cut.

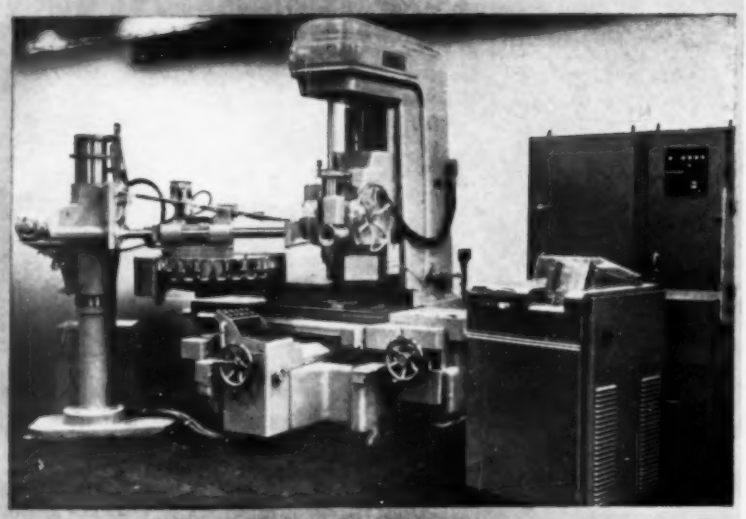
Tools preset in adjustable holders can, of course, be used to advantage whether tool changing is accomplished manually or automatically, but the greatest cost-cutting advantage is achieved when tool changing is completely under the control of the machine.

On the other hand, manual interchange of the tools in a machine spindle makes it possible for management to insist that the operator inspect the cutting edges of each tool before it is positioned for a cutting operation, and after it is removed. And a sizable expense for the automatic tool changing equipment is avoided.

Automatic tool changers, in their present state of development, do not insure that tools which are dulled or broken will not be used. However, experience to date with machines equipped with automatic changers indicates that this is not a serious problem as long as the machine operator is alert to the danger of using such tools and can be counted on to check the tools in a setup at fairly frequent intervals.

The problem of sensing automatically when a tool becomes dulled beyond a predetermined point, or is broken, and then shutting down the machine, is not insurmountable—but can be expensive, because of the number of different tools that are sure to be used in the same spindle

Rotary indexing motions . . .
and vertical adjustment of slide carrying four spindles on this Barnesdril machine are controlled by 8-channel tape. Multiple spindles are fed individually



Side frames for computing machines . . .
are machined automatically with 30 tools in this special IBM punched-card-controlled Fosdick jig borer equipped with tool-changing mechanism. Close tolerances are held while production is boosted

of a machine whose features include programmed automatic tool changes.

Tapping spindles in some plants have been equipped with separate drive motors, and demand meters have been connected in their power supply circuits. Then, when a meter needle climbs beyond a predetermined point while a tap is cutting, the operator knows the tap is dull and should be changed. There is no reason why such circuits could not be arranged to stop the machine when power demand for a given tool rises beyond a preset point or, on the other hand, is not sufficiently high—indicating the possibility of a too-short or broken tool.

Similarly, some sensing device like the electronic "Protect-O-Tool" coils announced early this year (*AM*—Mar 9 '59, p147) by Cross Co, or magnetic proximity switches now available from a number of suppliers, might economically be adapted for use on automatic machines to indicate, or automatically stop the machine, when lack of an induced current or failure of a proximity switch to operate at the proper moment would indicate that a tool is not in its proper position, or has been broken. Perhaps this would involve a sensing device and a control circuit for each individual tool—but economics one day may prove such arrangements well worth their cost.

Proximity pickup switches have been used very successfully to detect drill breakage at five drilling positions around a 6-station automatically indexed machine built recently by Buhr Machine Tool Co for an automotive-parts manufacturer. At each drilling station, a proximity switch pickup was supported at a set distance from the drill, and halfway between two drill guide bushings. Should a drill break, no flux path is provided below the switch pickup at that station when the drill head returns, and electric circuits are activated to shut down the machine and indicate with a light which drill has been broken.

Economic need for automatic tool changing on single-spindle, multi-purpose, numerically controlled machine tools is well evidenced by the speed with which they have been developed.

So far as we know, the first numerically-controlled, single-spindle machine tool requiring tool changes in the spindle nose, and incorporating automatic control of the sequence in which the tools are used, is the drilling, reaming, countersinking and tapping machine built more than two years ago by Barnes Drill Co for machining radial holes in stainless steel compressor cases.

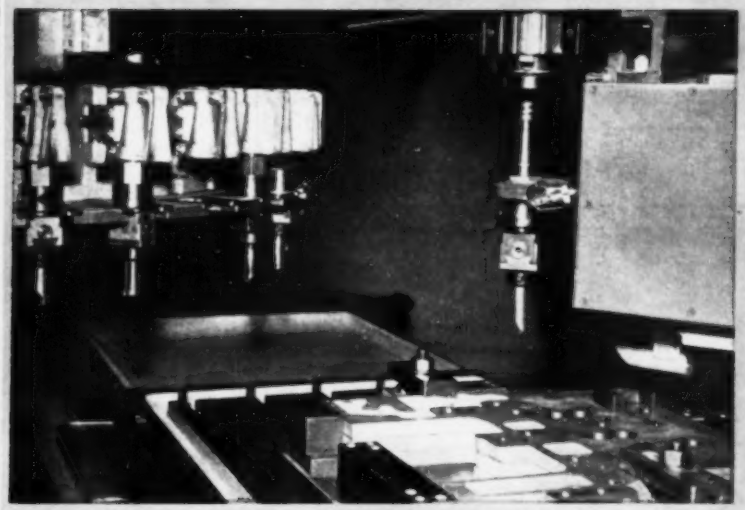
In this machine (*AM*—May 6 '57, p172; Oct 5 '59, p88), tools are preset in adjustable holders; those not in immediate use in the machine spindle are held in spring-loaded brackets along the top of a control console beside the machine. There are 13 of these brackets, any of which may be locked out, according to job requirements.

The machine will not function unless a tool in its preset adjustable holder is placed in each active position, except for the tool designated by the tape as the one to be used.

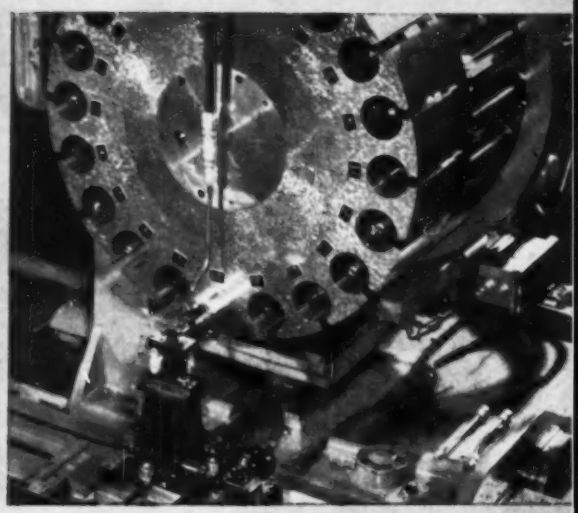
When a tool change is indicated in the perforated control tape, the machine spindle is stopped automatically and a signal lamp under the bracket holding the tool to be used next is illuminated.

The operator removes, from the machine spindle, the tool whose cuts have been completed, and replaces it in its supporting bracket. He then picks up the next tool, as indicated by the signal lamp, places it in the end of the spindle, and depresses the machine's cycle-start pushbutton.

If everything is in order, the machine then automatically starts its next machining cycle. Precision limit switches under each tool-support bracket are connected into the machine control circuits so the machine will operate only when one of the



Power wrench and circular tool rack . . .
are controlled in combination under control of punched cards to exchange tools between spindle and rack on IBM-Fosdick jig borer. Rapid tool changes help cut cost of job



Drills, taps and other cutting tools . . .
in center unit of three-machine, tape-programmed line at Hughes Aircraft Co plant are supported in horizontal, 20-position drum for indexing into spindle position

active tool support brackets is empty, and that bracket must be the one specified by the punched tape.

Next step in the development of automatic tool changing mechanisms probably was the perforated-tape-controlled, four-spindle automatic drilling, boring, reaming and tapping machine (*AM*—Dec 16 '57, p165) developed by Barnes Drill Co for machining more than 200 radial holes in the peripheries of cylindrical turbine engine parts up to 50-in. OD and up to 40-in. long. For a given job, a different tool is positioned in each of the four spindles, which are mounted one above the other in an automatically adjustable head mounted on vertical ways on one side of the machine column. Only one spindle can be used at a time, in whatever sequence is called for by the punched tape.

This arrangement is very efficient, so long as a maximum of four tools will be needed for each job programmed.

In another tape-controlled drilling, countersinking and tapping machine, recently shipped to the customer's plant for operations on missile nose cone sections, Barnes Drill Co has combined tool-control features from both of the above machines.

This latest Barnes unit has two spindles mounted one above the other in an automatically adjustable and tiltable head supported by a vertical column. Normally, a combination drill and countersink is mounted in the end of one spindle, and a tap is carried by the second spindle. Drills and taps for other sizes of holes are held in reserve in spring-loaded brackets on top of the machine's control console.

The machine will operate only when tools specified by the tape are in place in the two spindles, and the other tools for the job are suspended in their proper support brackets.

Card-controlled jig borer

Automatic tool selection and transfer are built into a special card-controlled jig borer (*AM*—Mar 10 '58, p156), developed jointly by the Manufacturing Research Dept of International Business Machines Corp, Endicott, NY, and Fosdick Machine Co. This system makes it possible to program all necessary operations on a given part without attention from the operator. Tools are interchanged faster than can be done manually.

This machine is easily set up for a wide range of parts within the capacity of the "Fosmatic" jig borer, just by providing a set of tools, a simple work-locating fixture, and a deck of punched cards for each different part. As many as 30 tools can be programmed for any given job.

Tools used in this machine, which include drills, reamers, boring heads, counterbores and countersinks, spotfacers, taps, etc, are preset in the toolroom in special adjustable holders. Each tool is numbered to correspond with both operating data punched into the control cards, and with tool support positions in a large, automatically indexed, circular rack suspended from a card-controlled slide at one side of the machine. The holders have tapered shanks to fit the nose of the machine spindle, and are threaded at the small end for locking into the spindle.

An automatic power wrench is mounted near the spindle to transfer tools between the circular rack and the machine spindle, and to hold each tool, in punched-card-specified seqence, while the slowly turning spindle locks the tool in place or loosens it, as the case may be.

With a new piece in position on the machine table, and a deck of punched cards in the IBM reader, this sequence is automatically performed to select and insert in the spindle nose the first tool required for the job, once the operator depresses the cycle-start pushbutton:

1. The machine spindle is retracted to the top of its travel.

2. The circular tool rack is in-

dexed to the specified location, by the shortest possible route. It holds this position until the selected tool is returned to its storage position at the end of the machining cycle now being initiated.

3. The tool rack is moved radially under the spindle.

4. The automatic power wrench advances and locks on a hexagon section machined on the tool holder just below the taper shank.

5. The tool rack is retracted to clear the machine, leaving the selected tool, with its shank upward, locked in the wrench.

6. Machine spindle is fed down and turned slowly, engaging the thread at the upper end of the toolholder shank and drawing the holder tightly into the spindle nose.

7. When a predetermined locking torque is reached, the wrench opens and retracts, clearing the space under the spindle.

8. Spindle feeds down at preset speed and feed rates, and the programmed operation is performed.

9. When the tool no longer is needed, the spindle is retracted to the level of the wrench, and the above steps are programmed in reverse sequence to return the tool in its holder to the tool rack.

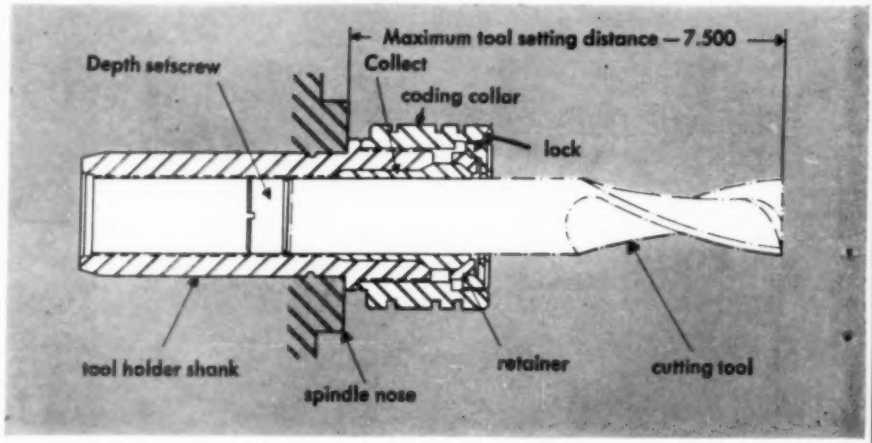
Throughout the machining cycle for each piece, the above sequence is repeated for each tool used. To save time during the tool change sequences, other machine functions which do not interfere with tool interchange operations—such as relocating the machine table—can be programmed for execution at the same time.

Setup time for this machine is reduced to locating the work-holding fixture on the table, loading the tool rack, placing a deck of cards in the IBM reader, and placing and removing the individual pieces. The machine operator checks the tools from time to time to insure that they are not dulled or broken.

Delays normal to conventional operations on jig borers, like manual adjustment of the table between settings, tool selection and setting, trial cuts and frequent gagings to see that holes are positioned accurately, and are of correct size, are eliminated. As a result, machining cycles are much shorter with this machine than with a conventional jig borer, whether the machine is used for tool work or for production operations.

Horizontal drum holds tools

An entirely different approach to automatic tool changing was developed for the horizontal drilling machine in the center of the "Digitape" perforated tape-controlled, three-machine transfer line developed jointly by Hughes Aircraft Co and Kearney & Trecker Corp (*AM*—Mar 24 '58, p98) and installed at the Hughes plant in El Segundo, Calif, to machine a variety of small parts in job-lot quantities.



In front of the drilling machine is a 20-position drum which serves as a magazine to hold up to that number of drills, reamers, counterbores, countersinks, taps and similar tools. Each drillhead carries its own guide bushing, which is extended as the tool advances, and each tap has its own leadscrew. When a tool breaks, a safety device automatically retracts the tool, stops the machine, and signals the operator.

Signals coded into the perforated tape for the drilling machine index the drum to position the various tools as they are needed, while other signals raise or lower the drill head and adjust the supporting column as may be necessary to center the tool with the hole to be machined in the work.

Separate perforated tapes are used to control each of the various parts machined on the three-machine line and the connecting transfer mechanism. Four tape readers are used, and one part is held on the transfer unit while a part is being processed in each of the three machines. Only one workholding fixture is needed for each different part to be machined—jigs are not needed, and material handling is cut back to the loading and unloading of the simple fixtures.

The Digitape control system employed on this line makes it economical to machine short runs of different parts—all to close tolerances.

Flexible Milwaukee-Matic

Almost any combination of milling, drilling, reaming, boring, counterboring, countersinking, undercutting and tapping operations can be performed in any required sequence on several sides of a piece on the flexible Model II Milwaukee-Matic combination production unit (*AM*—Dec 15 '58, p129) developed by Kearney & Trecker Corp.

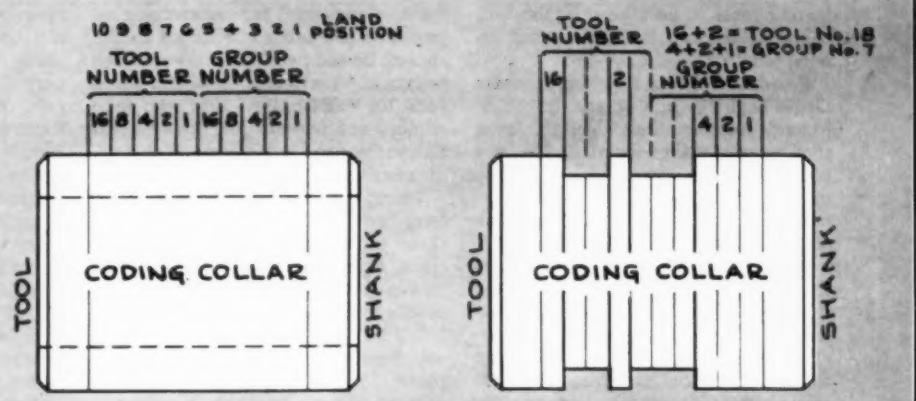
This fully automatic, punched-tape-controlled machine has a unique tool changing mechanism and a 30-station rotary tool magazine. Tools are held individually in adjustable holders which (1) locate the tools concentrically in the spindle nose and accurately against the front face of the spindle nose, and (2) identify each tool by means of coding rings.

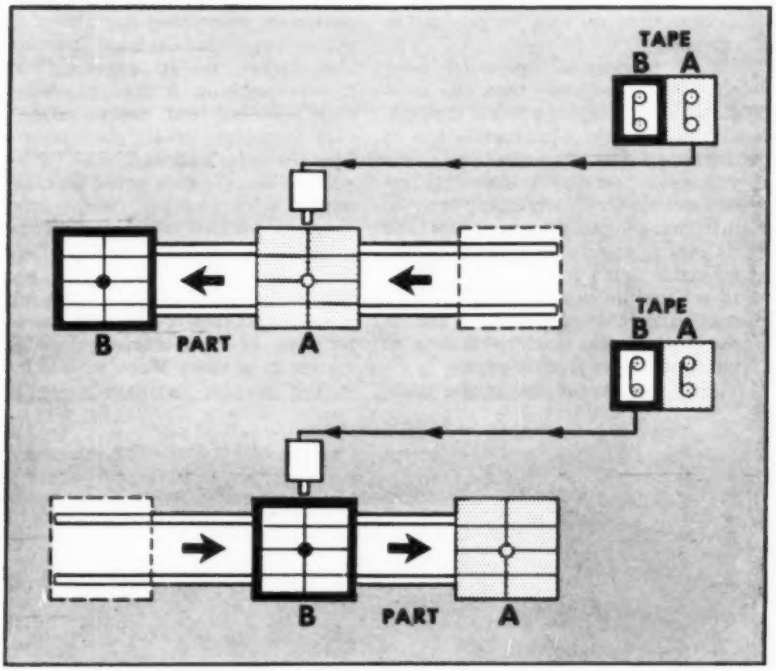
Coding collars on each holder, made up of various combinations of 10 land rings and groove rings (see sketch), identify each holder as it passes a reading head while the tool magazine is rotated. Half of the rings identify the *group* within which the tool is coded, the other half of the rings identify the number of the *tool* within the group. With this system, it is possible to code 31 tools within each of 31 different groups, or a total of 961 different tools.

Therefore, groups of tools for a relatively large number of jobs can be coded at the same time. This number is increased with the frequency with which some of the tools are repeated among the different jobs, because the same code number can be applied to a tool that is used for many jobs.

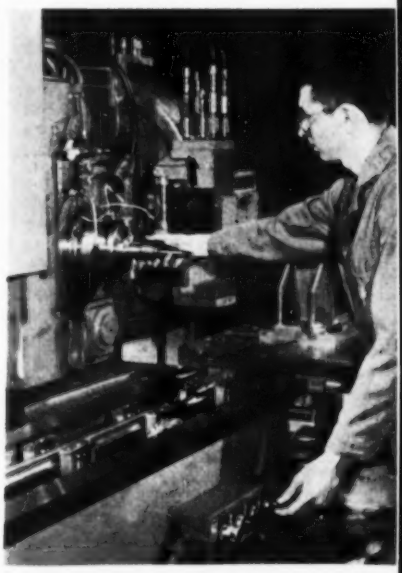
Tools can be loaded into the magazine in any sequence, and are trans-

Each toolholder is coded . . . for automatic handling in a Milwaukee-Matic, with various combination of land and groove rings. A total of 961 tools can be coded with this system, which adds electrically the numerical value of the land rings in the *group* and *tool number* sections to select any one of 31 different tools in any of 31 different groups





Tape-controlled shuttles . . . automatically move pallets *A* and *B* with fixtures for identical or different jobs to and from indexable table of the Milwaukee-Matic under control of tapes *A* and *B* in adjacent readers. Fixtures are unloaded and reloaded when pallets are away from machine table



Tools larger than 2⅝-in. OD . . . and/or which extend further than 7.500 in. from spindle nose, should not be loaded in tool magazine of the Milwaukee-Matic for automatic handling. Instead they should be fitted to the spindle nose manually when program tape stops machine. Such tools need not be coded

ferred to the machine spindle as indicated by code signals punched into the tape. Normally, tool search time (alignment of the next tool needed with the pickoff position) is programmed to take place automatically while the previously selected tool is cutting. Then less than 9 sec are required for the transfer arm to interchange tools between the spindle and the magazine.

In addition to programming the machine spindle to locate a tool accurately anywhere within a 20 x 24 in. area on the face of a workpiece, by vertical (*Y* axis) movement of the spindle head and horizontal (*X* axis) movement of the machine column, the Milwaukee-Matic programs spindle feed (*Z* axis) to a depth of 16 in. Generally, the spindle can be repeatedly positioned to within 0.0005 in. of a specified dimension on the *X* and the *Y* axes, and to a depth (*Z* axis) within 0.001 in.

For each job routed to a Milwaukee-Matic and, for that matter, to all similar machines using discrete numerical-control systems, the process engineer programming the operations must specify the tools to be used, their size, and when they are to be employed.

Delays for manual tool changes, and proper sequences for automatic tool changes, are both punched into the tape and listed on a process planning sheet or job card which is delivered to the machine operator with

the work order. This aids him in selecting tools to be placed in the tool changing magazines when setting up new jobs.

For the Milwaukee-Matic, tools larger than 2⅝-in. OD, and/or which extend further than 7.500 in. from the spindle face usually are not placed in the magazine for automatic changing, but are reserved for manual loading, as they may cause clearance problems.

In some setups, tools extending as much as nine inches from the spindle face have been handled automatically from the magazine of the Model II Milwaukee-Matic, but when this is done the programmer must make sure the spindle is moved far enough away from the work that the moving tool will not catch on the work or fixture as it is moved into the spindle.

The tool magazine of the Model II Milwaukee-Matic has capacity for 30 different tools in coded holders. With one tool in the spindle, the machine therefore has capacity for 31 different, automatically transferred tools at a time.

Where more than 31 such tools are needed for a job, programmed stops must be punched in the tape to aid the operator in removing and replacing tools in the magazine. These stops must be so located in the machine cycle as to permit a group of tools used only during the early portion of the cycle to be replaced with tools to be used only during the latter portion. Color codes can help identify such groups of tools.

Indexable tables and pallets

To further increase the flexibility of the Milwaukee-Matic, the Model II unit normally is equipped with an 8-position, automatically indexable table, with index positions 45° apart. For jobs which have faces spaced at other angles, a numerically controlled rotary table with 360° positioning to an accuracy of 20 sec of arc, can be installed in place of the 8-position table.

Work-locating fixtures used with the Milwaukee-Matic are mounted on movable pallets, rather than directly on the machine table. These pallets are positioned and removed from the table with overhead hoists, or by sliding them along rails.

To attain maximum production efficiency, the Milwaukee-Matic can be equipped with tape-controlled pallet shuttles (see photos and sketch) on both sides of the indexable table, so one pallet can be unloaded and reloaded to one side of the machine while a piece on the second pallet is being machined. With this arrangement, downtime for interchanging pieces on the table is reduced to the approx 30 sec needed to interchange pallets automatically. Separate tapes (one for each pallet) and two tape readers are needed for the General Electric control system when this arrangement is used.

The shuttle device in no way interferes with the indexing of the machine table, nor with any other machine functions, so the combination makes possible several cost-cutting production advantages:

1. Pallets at both ends of the table can be used for machining identical parts, thus minimizing setup time delays between production cycles.

2. Entirely different parts, or operations on opposite sides of the same part, can be programmed alternately, with no loss in production efficiency.

3. A production operation need not be delayed more than one complete machine cycle when it is necessary to cut into a production run to machine a part of another design for emergency service or assembly requirements—it is necessary only to interchange one of the pallets and its control tape, and to load the tool magazine with the necessary tools, to set up the machine for the new part. And most of this work can be done while the machine still is at work on the preceding part.

With or without the shuttle table, double-faced fixtures (see photo) mounted on standard pallets often can be used advantageously to machine both sides of a piece where part design makes such setups difficult. With the double-faced design, fixtures hold the part against one face on one side, and against the opposite face on the other side. Rough workpieces first are loaded in the fixture on the No. 1 side and machined on the exposed face, then removed and loaded into the No. 2 side of the fixture for machining the opposite face. Except for the first and last pieces of a lot, there are two pieces in the fixture at all times and a part is completed for each full index of the table.

Good programming cuts costs

Process planning for numerically controlled machining operations involves two closely related functions —workpiece design planning and tape preparation. A third function—tool planning and design—also is very important if all possible savings are to be achieved.

Close coordination must be maintained with product design engineers to insure that part shape, dimensions and tolerances lend themselves to most-economic programming, and that part drawings are dimensioned to suit the characteristics of the numerical-control system to be used. Much time is lost if the process engineer must re-

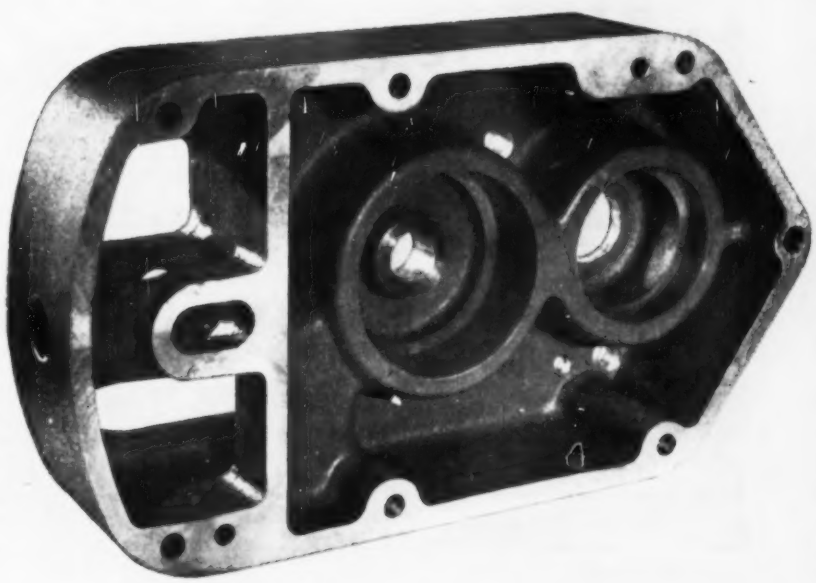
Conventional Methods vs. Milwaukee-Matic Setups

			Conventional Machine Tools				Milwaukee-Matic With Shuttles			
Name of Part	Type of Material	Lot Size	No. of Machs.	Cost of Tooling	Total Setup Time (Hours)	Total Cycle Time Per Part (Hours)	No. of Machs.	Cost of Tooling	Total Time to Prepare Tape (Hours)	Total Cycle Time Per Part (Hours)
Switch Bracket	Cast Iron	15	5	$1890	4.63	0.64	1	$306	25	0.21
Manifold	Cast Iron	30	5	$1300	3.30	0.70	1	$430	30	0.36
Gear(*) Housing	Cast Aluminum	10	6	$3200	32.50	9.70	1	$850	40	1.00
Cylinder Block	Cast Magnesium	10	5	$1800	12.50	2.80	1	$750	25	0.40
Table Bracket	Cast Iron	10	6	$4700	11.44	2.64	1	$1900	35	0.70
Motor Base	Cast Aluminum	15	6	$2350	4.48	1.86	1	$835	30	0.65
Toolholder Cartridge(**)	Cast Bronze	150	5	None	5.25	1.30	1	$800	25	0.40

Notes: No setup time is given for the Milwaukee-Matic because, in normal operating procedures when using a machine equipped with automatic shuttles and two tape readers, it is common practice to set up for one job at one side of the machine while finishing a previous job on the other side. Time lost for setups therefore usually is minimal. Time shown for preparing tapes includes time spent in redimensioning drawings and checking the punched tape by type-out on a Flexowriter automatic typewriter. When part drawings are dimensioned on *X* and *Y* axes, much tape preparation time will be saved.

*The gear housing (see photo) was not machined complete on the Milwaukee-Matic. Operations completed prior to setting job up on Milwaukee-Matic included work done on a boring mill and a drill press. Comparison shown is only for work done on the Milwaukee-Matic.

**No special tools were required when the tool holder cartridges were machined on conventional machine tools. Parts were held in standard machine vises.



Double-faced fixture . . . for cast SAE 326 aluminum motor base is bolted to one pallet (left), and smaller fixture to hold Milwaukee-Matic tool cartridge vertically for second operations is on second pallet (right) in this setup on Model II Milwaukee-Matic. Operator is placing tools in changer magazine

Deep-cored cast-aluminum base... 14-in. long, 7¾-in. wide and 3-in. deep, for a K&T milling-machine attachment, originally was machined in 1.86 hr, using separate setups on six conventional machine tools. With a $835 double-faced fixture on Milwaukee-Matic it is machined in 0.65 hr, using 27 automatically changed tools and 4 manually positioned tools. Programming the tape for this operation required approx 30 hr

dimension a drawing before he can prepare process planning sheets.

When the product design engineer understands the capabilities and limitations of the machine on which a part is to be processed, he usually can plan the design so best use is made of available facilities. This holds true no matter what facilities are to be used—but is especially important when numerical controls are involved. By simply standardizing on hole and thread sizes, arranging part shapes so they can be readily machined with a few movements of standard tools, minimizing the need for special tools and work-locating fixtures, etc, he can simplify many machining problems.

In addition, the process engineer can affect the cost and quality of the product to a major extent. Planning a sequence of operations to minimize tool changing and other time-consuming, non-productive portions of a machining cycle, he can hold the total cycle time to a minimum.

As shown in the accompanying data flow diagram, the tool designer also occupies a key position in minimizing machining costs, particularly when numerically controlled combination machines, like the Milwaukee-Matic, are involved. The process engineer and the tool designer must collaborate closely, because design of cutting tools and holding fixtures has a direct effect upon, and in turn is affected by, the sequence in which the part is to be machined.

Together, the process engineer and the tool designer must decide how to hold the work so a maximum number of operations can be performed on the required surfaces of the part, using the minimum number of holding fixtures. They must agree, too, on whether standard cutting tools should be used, or if it will be advantageous to combine some cuts by making one or more special tools.

Once these details have been worked out, the process engineer can prepare his machining program for the part, using a process planning sheet (see sample) designed to suit the characteristics of the machine and its control system.

Results point to profits

Major reductions in machining time and factory cost have been achieved with all of the machines described. On some jobs, reductions in floor-to-floor time have ranged only from 30 to 50%—in others, it has ranged as high as 75 to 90%. To these savings must be added major reductions in tooling cost, increased life of cutting tools between resharpenings, and much higher machine utilization efficiencies.

Results reported by Kearney & Trecker on some of the more than 50 different workpieces which have been processed over a shuttle-equipped Model II Milwaukee-Matic are listed in the table on page 163. These and other reports of cost reductions when using numerically controlled machines almost always have been the result of short-run operations. It is in this field that the point-to-point numerically controlled machine tools now appear to have their most promising future.

There now seems to be little advantage in applying numerical controls to machining operations where parts are required in large quantities. Automated lines still will produce parts at lower costs when volume requirements justify the high cost of such installations.

However, it must be remembered that in even the most efficient mass-

KEARNEY & TRECKER **MILWAUKEE-MATIC** PROCESS PLANNING SHEET

Form No. 3574 - 374

Order No.	Unit No.	Material	Part Name	Draw. Date	Part No.	Operation No.	Tape No.	Page / of 5
		AMPCO BRZ. #18	DRUM CARTRIDGE	536491		65	52422	Date 3/6/59 Planner J.P.

Seq. No.	Operation and Tool	Time	Longitudinal (X)	Vertical (Y)	Depth (Z)	Feed Rate	Spindle Speed	Tool Group	Tool No.	Aux. Function	Index	Slope and Arc Start	Slope and Arc End	Slope and Arc Radius	Slope and Arc Dir.
1	POSITION X,Y AND Z	.054	05 | 3500	09 | 8875	00 | 000			03	14	07	2				
2	CHANGE TOOL	.134								05					
3	[2] POSITION Z	.078	05 | 3500	09 | 8875	15 | 380		0.350			02					
4	ROUGH MILL (B-1) ↓	.491		04 | 0000		12	0350	01	07						
5	ROUGH MILL (B-1) →	.150	06 | 6625			12	0.350								
6	POSITION Z	.030			15 | 936		0400								
7	FINISH MILL (B-1) ←	.113	05 | 3500			16	0400								
8	FINISH MILL (B-1) ↑	.369		09 | 8875		16	0400								
9	POSITION X	.030	07 | 2875				0340								
10	POSITION Y AND Z	.030		08 | 4500	16 | 194		0340								
11	ROUGH MILL (B-2) ↓	.560		01 | 7625			0340								
12	POSITION Z	.030			16 | 210		0340								

production plants, some parts are made in relatively small quantities and job-lot quantities are determined by economic lot size formulas. A recent survey is reported to have shown that more than 75% of all metalworking plants make parts in lots of 25 or less.

It is in this field, where most machining has in the past been performed on general-purpose machine tools, that the discrete-positioning type of numerical-control systems are showing the greatest cost-reduction possibilities. Because tooling costs can be held at low levels, and setup time is minimized, the numerically programmed machines show good possibilities.

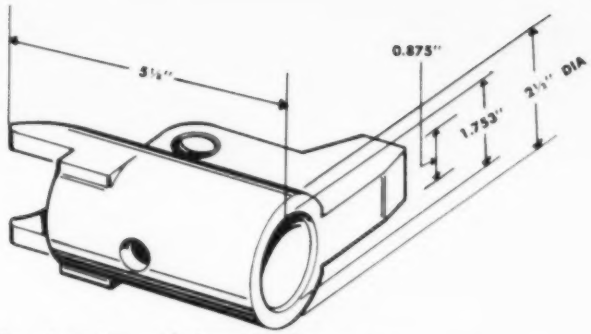
Several studies during recent years have indicated that the average general-purpose machine tool is cutting metal only 25 to 35% of the time when using high-speed-steel tools, and only 15 to 20% of the time when using carbide-tipped tools.

Compare these values with the apparently justified claim that a properly designed and tooled perforated-tape or card-controlled machine equipped with devices for automatically interchanging tools and workpieces will be found to be cutting chips close to 75% of its total cycle time!

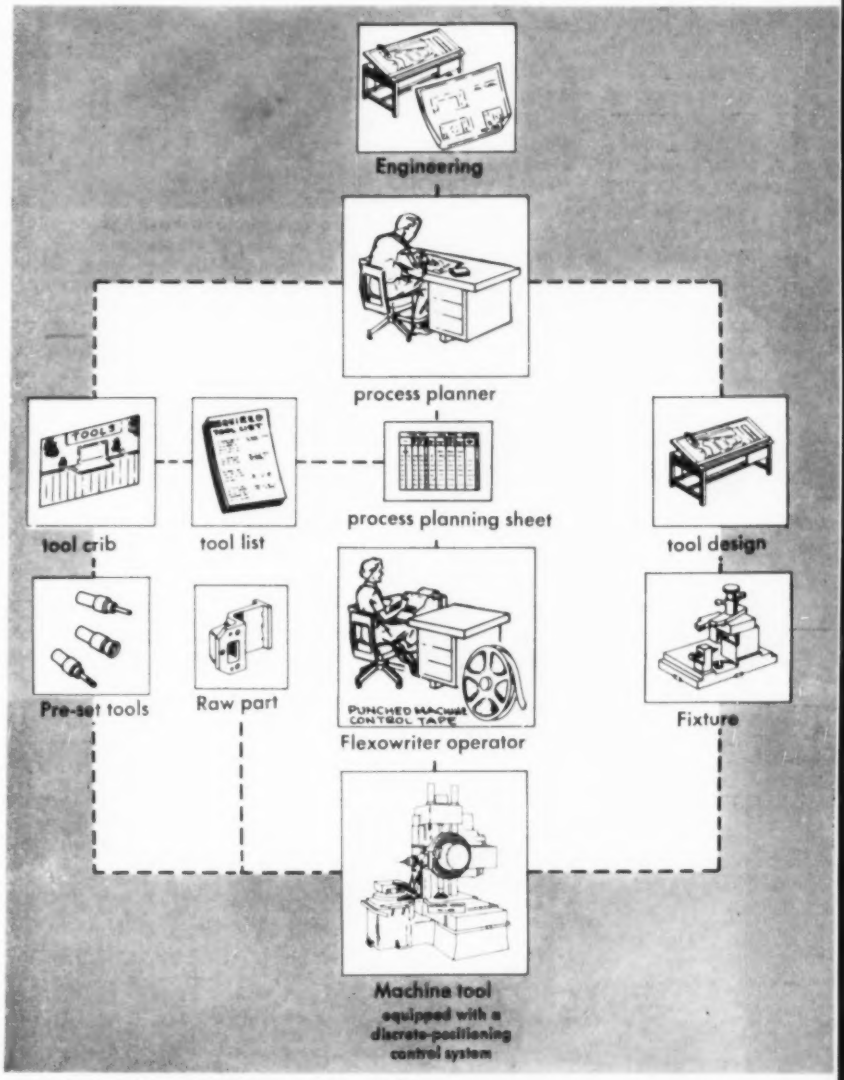
It is of particular interest to note that Kearney & Trecker is machining the cast Ampco-18 aluminum bronze tool-holder cartridges for Milwaukee-Matic tool magazines on a Milwaukee-Matic unit. As shown in accompanying illustrations, a fixture for one of the two operations on these parts often is mounted on one pallet while tooling for a test or demonstration part is placed on the other pallet of the shuttle-equipped machine.

Had these tool-holder cartridges been scheduled through the K&T machine shop in the normal manner, it would have been necessary to send them to five different machines in succession—turret lathe, horizontal milling machine, belt sander, horizontal-spindle boring machine, and sensitive drillpress—with a total cycle time of 1.30 hr per piece. Conventional vises, etc, would have been used to hold the parts, so no special tools would have been necessary. But economic lot sizes would have had to range between 150 and 300 pieces per order, and space for storing both work-in-process parts between the five machines and for warehousing the finished parts would have been needed.

To program two operations on these parts on the Model II Milwau-



Two locating and clamping fixtures . . .
and 22 automatically-changed cutting tools are used on the Model II Milwaukee-Matic to machine these cast aluminum-bronze toolholder cartridges in 0.40 hr total time. At least 1.30 hr would have been needed to machine them by conventional methods, in 5 different machine tools



Process planners occupy a key position . . .
in the success of any numerically controlled manufacturing setup. They translate product design information and knowledge of manufacturing procedures into instructions to the tool designer, the tape transcribers, and the tool crib for presenting tools

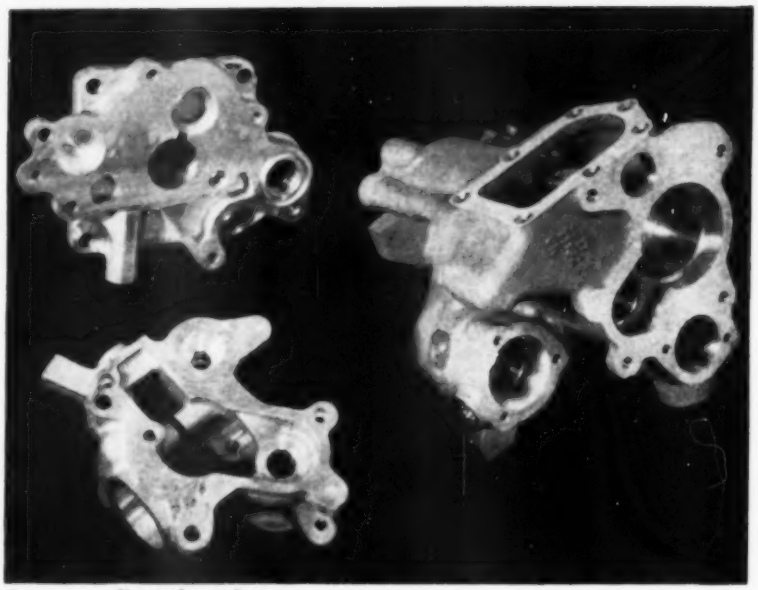
kee-Matic, it was necessary to make two special fixtures, one costing $475 and the other $325, and to prepare two punched tapes at an expenditure of 25 to 30 hr of an experienced process engineer's time.

As a result, the parts now are machined only as needed—eliminating much materials handling and parts-in-process storage in the shop, as well as the expense of providing storage space for finished parts—in a total floor-to-floor time (for both operations) of only 0.40 hr.

Far-reaching effects

Discrete - positioning numerical control, fundamentally, replaces "tooling" in terms of jigs and fixtures as it is conventionally known. It has been said that the use of a positioning table which locates a point by the *X* and *Y* axes only replaces tooling and that additional control over the *Z* axis, or depth control, replaces the operator. For full automatic control, of course, all three axes must be controlled. However, it adds much more than a third to the cost to add a third axis because the system then must be self reliant and additional precautions and safeguards are desirable. With full automatic control it becomes even more important to have automatic tool changing. This, too, adds to the total cost—not only in additional mechanical equipment but in control equipment as well.

For some people, some job requirements, and some budgets, a simple numerically controlled two-axis positioning table may be the answer. It alone will drastically reduce tooling costs and will permit substantial increases in productivity — even though an operator must be in attendance and must change the tools when necessary.



Even complicated castings . . .
like these cast-aluminum housing, cover and flange parts for Chandler Evans fuel control systems machined in a test setup on a Model II Milwaukee-Matic are easily programmed for automatic production in relatively small job lots. Estimated reductions in machining time for these parts range from 19 to 41%, with setup time cut from 22 to 32%

Where the manufacturing load indicates full utilization, other people will want to take advantage of all of the benefits possible under numerical programming and control. For these people, three-axis (or more) control, multiple spindles, and automatic tool changing are practical.

In either degree of control, it is the replacement of tooling that offers major savings. In evaluating the cost of numerical-control equipment, people will tend to compare it with existing automatic and manually controlled machines. They frequently ignore that, during its life, they may spend from three to ten or more times the original cost of a conventional machine tool for jigs and fixtures. And it doesn't even consider the setup charges. When the savings in tooling and setup are added to the shortened lead time, the reduced scrap, and the greatly reduced parts inventory, this kind of equipment cannot be considered "expensive" except at the price tag—and even that is not always as expensive as some talk about more complex equipment has people believing.

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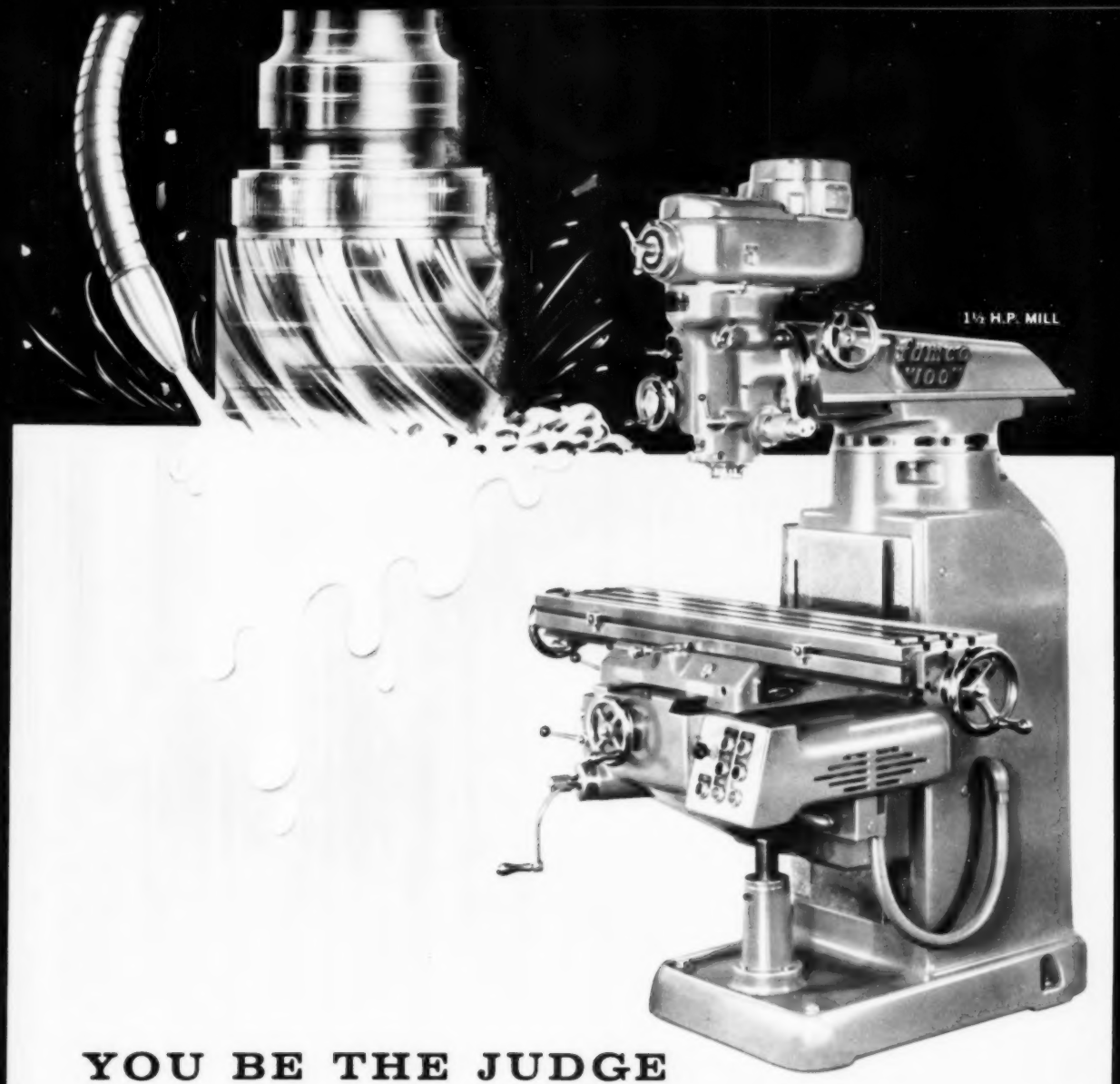

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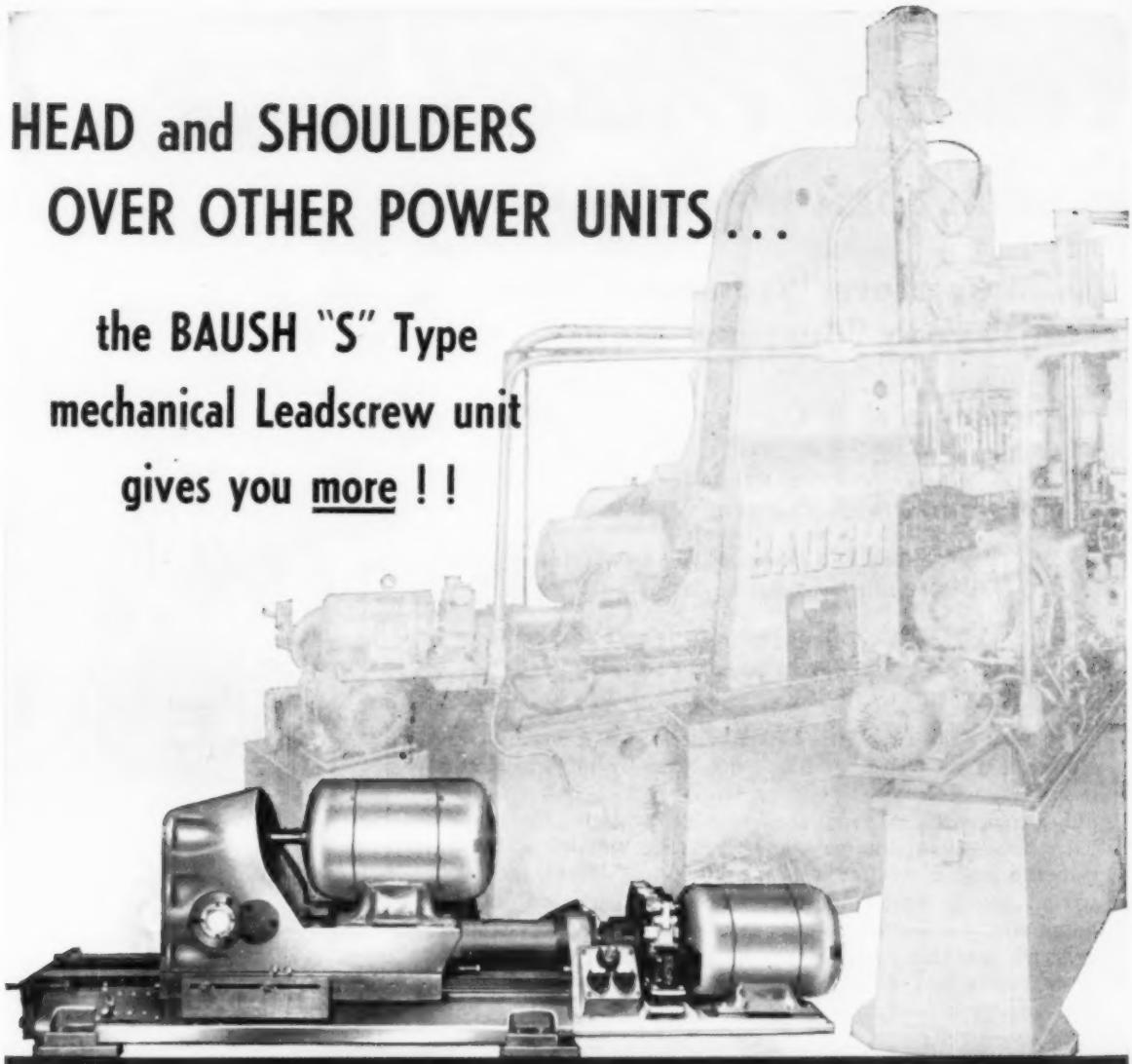

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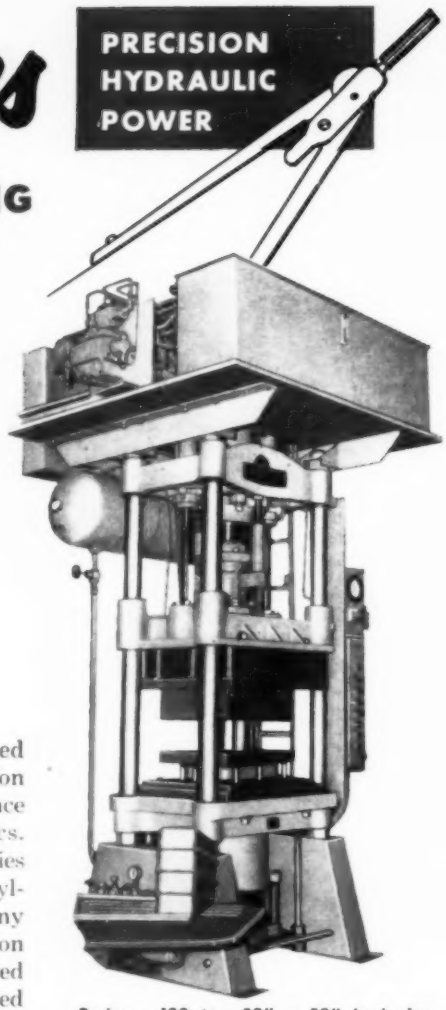

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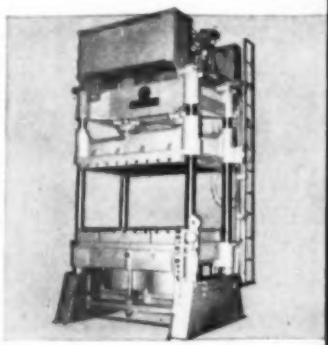
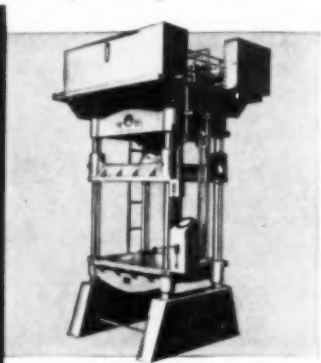
This new Rodgers Catalog has complete specifications, tables and data, making it simple to determine the press for the job. Write for your copy without obligation.



Rodgers twin cylinder, twin die cushion, 200 ton drawing press with 60" x 48" bed; single cycle automatic.



Rodgers 100 ton press, 36" x 36" bed with single lever pressure sensitive manual control.

HYDRAULICS Rodgers KEEP THE WORLD MOVING

RODGERS HYDRAULIC, Inc.

Pioneers in High Pressure Hydraulics Since 1932

7475 WALKER STREET • MINNEAPOLIS 26, MINNESOTA

American Machinist

REFERENCE BOOK SHEET

Temperature Corrections for Dimensions – VII

By H K Eitelman, ordnance department, General Electric Co, Pittsfield, Mass

(See AM–Oct 5 '59, p 113 for explanations)

Magnesium

Temp	Correction Factors for Dimensions				
	.5-1.49	1.5-2.49	2.5-3.49	3.5-4.49	4.5-5.49
69	0.000014	0.000029	0.000043	0.000058	0.000072
70	0.000029	0.000058	0.000086	0.000115	0.000144
71	0.000043	0.000086	0.000130	0.000173	0.000216
72	0.000058	0.000115	0.000173	0.000230	0.000288
73	0.000072	0.000144	0.000216	0.000288	0.000360
74	0.000086	0.000173	0.000259	0.000346	0.000432
75	0.000101	0.000202	0.000302	0.000403	0.000504
76	0.000115	0.000230	0.000346	0.000461	0.000576
77	0.000130	0.000259	0.000389	0.000518	0.000648
78	0.000144	0.000288	0.000432	0.000576	0.000720
79	0.000158	0.000317	0.000475	0.000634	0.000792
80	0.000173	0.000346	0.000518	0.000691	0.000864
81	0.000187	0.000374	0.000562	0.000749	0.000936
82	0.000202	0.000403	0.000605	0.000806	0.001008
83	0.000216	0.000432	0.000648	0.000864	0.001080
84	0.000230	0.000461	0.000691	0.000922	0.001152
85	0.000245	0.000490	0.000734	0.000979	0.001224
86	0.000259	0.000518	0.000778	0.001037	0.001296
87	0.000274	0.000547	0.000821	0.001094	0.001368
88	0.000288	0.000576	0.000864	0.001152	0.001440
89	0.000302	0.000605	0.000907	0.001210	0.001512
90	0.000317	0.000634	0.000950	0.001267	0.001584

Magnesium

Temp	Correction Factors for Dimensions				
	5.5-6.49	6.5-7.49	7.5-8.49	8.5-9.49	9.5-10.49
69	0.000086	0.000101	0.000115	0.000130	0.000144
70	0.000173	0.000202	0.000230	0.000259	0.000288
71	0.000259	0.000302	0.000346	0.000389	0.000432
72	0.000346	0.000403	0.000461	0.000518	0.000576
73	0.000432	0.000504	0.000576	0.000648	0.000720
74	0.000518	0.000605	0.000691	0.000778	0.000864
75	0.000605	0.000706	0.000806	0.000907	0.001008
76	0.000691	0.000806	0.000922	0.001037	0.001152
77	0.000778	0.000907	0.001037	0.001166	0.001296
78	0.000864	0.001008	0.001152	0.001296	0.001440
79	0.000950	0.001109	0.001267	0.001426	0.001584
80	0.001037	0.001210	0.001382	0.001555	0.001728
81	0.001123	0.001310	0.001498	0.001685	0.001872
82	0.001210	0.001411	0.001613	0.001814	0.002016
83	0.001296	0.001512	0.001728	0.001944	0.002160
84	0.001382	0.001613	0.001843	0.002074	0.002304
85	0.001469	0.001714	0.001958	0.002203	0.002448
86	0.001555	0.001814	0.002074	0.002333	0.002592
87	0.001642	0.001915	0.002189	0.002462	0.002736
88	0.001728	0.002016	0.002304	0.002592	0.002880
89	0.001814	0.002117	0.002419	0.002722	0.003024
90	0.001901	0.002218	0.002534	0.002851	0.003168

Kaiser Aluminum doubles capacity with new Bliss hydraulics

Unusual control system provides broad job shop work range in both hand and closed die forging . . . This 8,000-ton Bliss Hydro-Dynamic* press, together with similar 3,000-ton and 5,000-ton presses, are the key units in the recently completed $5 million press department at Kaiser Aluminum & Chemical Corporation's Erie, Pa., plant. The presses have doubled Kaiser Aluminum's capacity to produce a broad range of aluminum forgings for commercial applications, as well as for aircraft and missile components.

In spite of their size, the presses have unusual flexibility: the multiple cylinder design of the two larger units and novel automatic control systems provide precise, stroke-after-stroke regularity of forging speed and pressure.

What's your press need? In everything from bench presses to giant hydraulics, you'll find the greatest reliability . . . and the most advanced engineering . . . in a Bliss.

*Registered trademark E. W. Bliss Company

BLISS
SINCE 1837

E. W. BLISS COMPANY · Canton, Ohio

BLISS is more than a name—it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CONTAINER MACHINERY • CONTRACT MFG.

CIRCLE 265 READER SERVICE CARD

Temperature Corrections for Dimensions – VIII

Magnesium

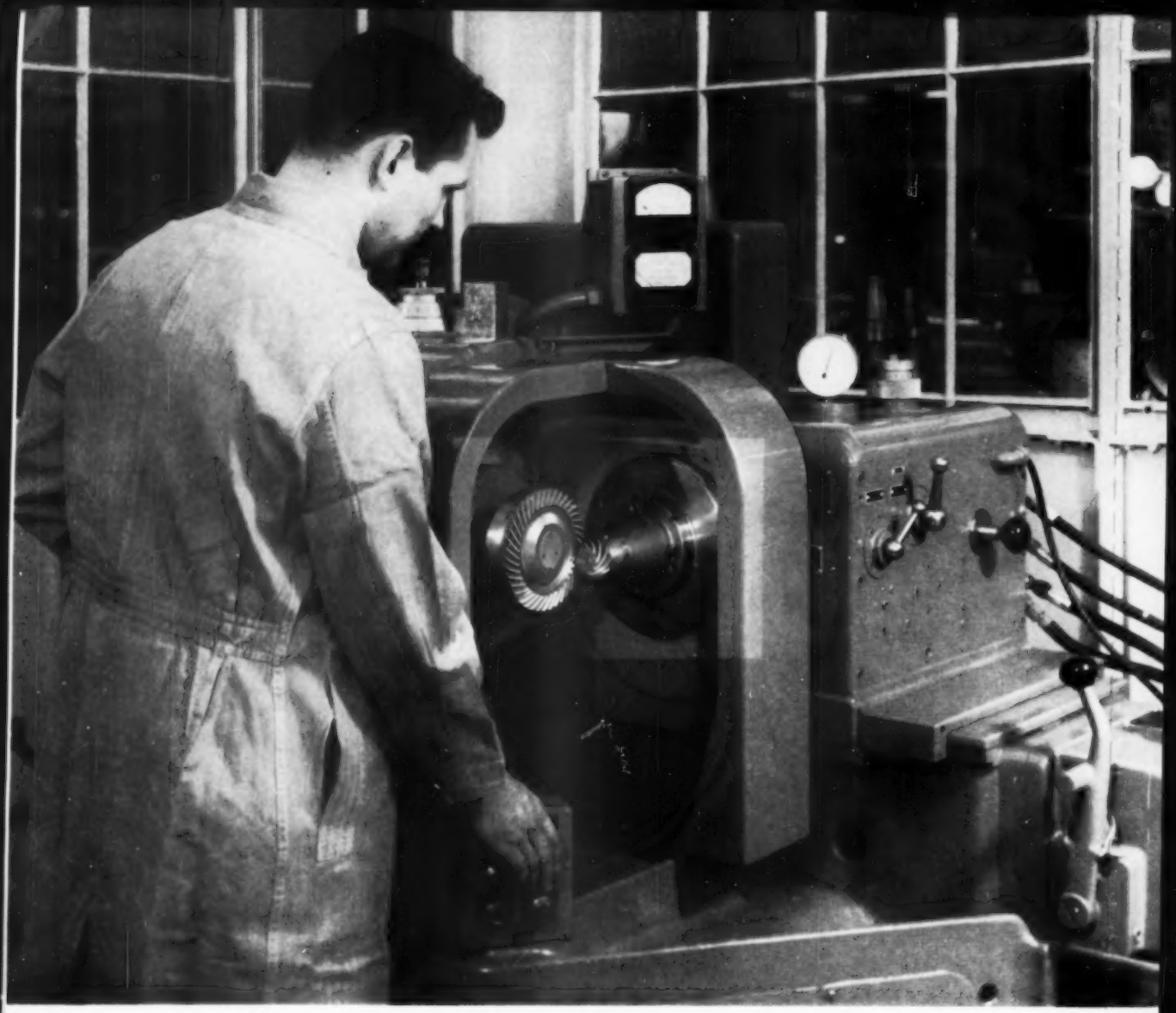
Correction Factors for Dimensions

Temp	10.5-11.49	11.5-12.49	12.5-13.49	13.5-14.49	14.5-15.49
69	0.000158	0.000173	0.000187	0.000202	0.000216
70	0.000317	0.000346	0.000374	0.000403	0.000432
71	0.000475	0.000518	0.000562	0.000605	0.000648
72	0.000634	0.000691	0.000749	0.000806	0.000864
73	0.000792	0.000864	0.000936	0.001008	0.001080
74	0.000950	0.001037	0.001123	0.001210	0.001296
75	0.001109	0.001210	0.001310	0.001411	0.001512
76	0.001267	0.001382	0.001498	0.001613	0.001728
77	0.001426	0.001555	0.001685	0.001814	0.001944
78	0.001584	0.001728	0.001872	0.002016	0.002160
79	0.001742	0.001901	0.002059	0.002218	0.002376
80	0.001901	0.002074	0.002245	0.002419	0.002592
81	0.002059	0.002246	0.002434	0.002621	0.002808
82	0.002218	0.002419	0.002621	0.002822	0.003024
83	0.002376	0.002592	0.002808	0.003024	0.003240
84	0.002534	0.002765	0.002995	0.003226	0.003456
85	0.002693	0.002938	0.003182	0.003427	0.003672
86	0.002851	0.003110	0.003370	0.003629	0.003888
87	0.003010	0.003283	0.003557	0.003830	0.004104
88	0.003168	0.003456	0.003744	0.004032	0.004320
89	0.003326	0.003629	0.003931	0.004234	0.004536
90	0.003485	0.003802	0.004118	0.004435	0.004752

Magnesium

Correction Factors for Dimensions

Temp	15.5-16.49	16.5-17.49	17.5-18.49	18.5-19.49	19.5-20.49
69	0.000230	0.000245	0.000259	0.000274	0.000288
70	0.000461	0.000490	0.000518	0.000547	0.000576
71	0.000691	0.000734	0.000777	0.000821	0.000864
72	0.000922	0.000970	0.001037	0.001094	0.001152
73	0.001152	0.001224	0.001296	0.001368	0.001440
74	0.001382	0.001469	0.001555	0.001642	0.001728
75	0.001613	0.001714	0.001814	0.001915	0.002016
76	0.001843	0.001958	0.002074	0.002189	0.002304
77	0.002074	0.002203	0.002333	0.002462	0.002592
78	0.002304	0.002448	0.002592	0.002736	0.002880
79	0.002534	0.002693	0.002851	0.003010	0.003168
80	0.002765	0.002938	0.003110	0.003283	0.003456
81	0.002995	0.003182	0.003370	0.003557	0.003744
82	0.003226	0.003427	0.003629	0.003830	0.004032
83	0.003456	0.003672	0.003888	0.004104	0.004320
84	0.003686	0.003917	0.004147	0.004378	0.004608
85	0.003917	0.004162	0.004406	0.004651	0.004896
86	0.004147	0.004406	0.004665	0.004925	0.005184
87	0.004378	0.004651	0.004925	0.005198	0.005472
88	0.004608	0.004896	0.005184	0.005472	0.005760
89	0.004838	0.005141	0.005443	0.005746	0.006048
90	0.005069	0.005386	0.005702	0.006019	0.006336



Now you can *speed-test* gears up to 4000 RPM

Since the accuracy of any gear test depends on how well it simulates actual operating conditions, we've developed a hypoid tester with speeds up to 4000 RPM. The higher range of speed on the No. 17A-4000 Hypoid Tester makes possible a new standard in the testing of bevel gears.

Complete testing on one machine. The No. 17A-4000 Hypoid Tester is arranged for both power and slow rolling tests. With the power test you can observe a gear's smoothness of operation, its noise characteristics, and its tooth contact pattern.

Roll test the gear and you get accurate readings of its eccentricity, tooth size, spacing, and profile.

With the No. 17A-4000 Tester you can test any right angle straight bevel, Zerol® bevel, spiral bevel and hypoid gear of any pitch and up to 20" OD.

Pre-set backlash control. The No. 17A-4000 Tester has a new hydraulic backlash control mechanism. The control automatically duplicates your pre-set backlash value when you change the relative positions of a gear pair to simulate actual operation.

Exact duplication of settings. Indicator set-up fixtures are available for large quantity testing. With these gages you can make identical settings on a battery of machines, or get the same setting repeatedly on a single machine.

New bulletin. We've prepared a bulletin on the No. 17A-4000 Hypoid Tester to answer any questions you might have about its construction or operation. Write for a copy.

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

CIRCLE 266 READER SERVICE CARD

Temperature Corrections for Dimensions – IX

Magnesium

Temp	Correction Factors for Dimensions					
	20.5-21.49	21.5-22.49	22.5-23.49	23.5-24.49	24.5-25.49	
69	0.000302	0.000317	0.000331	0.000345	0.000356	
70	0.000625	0.000634	0.000662	0.000691	0.000720	
71	0.000907	0.000950	0.000937	0.001037	0.001080	
72	0.001210	0.001267	0.001325	0.001382	0.001440	
73	0.001512	0.001584	0.001656	0.001728	0.001800	
74	0.001814	0.001901	0.001987	0.002074	0.002160	
75	0.002117	0.002218	0.002318	0.002419	0.002520	
76	0.002419	0.002534	0.002650	0.002765	0.002880	
77	0.002722	0.002851	0.002981	0.003110	0.003240	
78	0.003024	0.003168	0.003312	0.003456	0.003600	
79	0.003326	0.003485	0.003643	0.003802	0.003960	
80	0.003628	0.003802	0.003974	0.004147	0.004320	
81	0.003931	0.004118	0.004306	0.004493	0.004680	
82	0.004234	0.004435	0.004637	0.004838	0.005040	
83	0.004536	0.004752	0.004968	0.005184	0.005400	
84	0.004838	0.005069	0.005299	0.005530	0.005760	
85	0.005140	0.005386	0.005630	0.005875	0.006120	
86	0.005443	0.005702	0.005962	0.006221	0.006480	
87	0.005745	0.006019	0.006293	0.006566	0.006840	
88	0.006048	0.006336	0.006624	0.006912	0.007200	
89	0.006350	0.006653	0.006955	0.007258	0.007560	
90	0.006653	0.006970	0.007286	0.007603	0.007920	

Magnesium

Temp	Correction Factors for Dimensions					
	25.5-26.49	26.5-27.49	27.5-28.49	28.5-29.49	29.5-30.49	
69	0.000374	0.000393	0.000403	0.000418	0.000432	
70	0.000749	0.000778	0.000806	0.000835	0.000864	
71	0.001123	0.001166	0.001210	0.001253	0.001296	
72	0.001498	0.001555	0.001613	0.001670	0.001728	
73	0.001872	0.001944	0.002016	0.002088	0.002160	
74	0.002246	0.002333	0.002419	0.002506	0.002592	
75	0.002621	0.002722	0.002822	0.002923	0.003024	
76	0.002995	0.003110	0.003226	0.003341	0.003456	
77	0.003370	0.003499	0.003629	0.003758	0.003888	
78	0.003744	0.003888	0.004032	0.004176	0.004320	
79	0.004118	0.004277	0.004435	0.004594	0.004752	
80	0.004493	0.004666	0.004348	0.005011	0.005184	
81	0.004867	0.005054	0.005242	0.005429	0.005616	
82	0.005242	0.005443	0.005645	0.005847	0.006048	
83	0.005616	0.005832	0.006049	0.006264	0.006480	
84	0.005990	0.006221	0.006451	0.006682	0.006912	
85	0.006365	0.006610	0.006854	0.007099	0.007344	
86	0.006739	0.006999	0.007258	0.007517	0.007776	
87	0.007114	0.007387	0.007661	0.007934	0.008208	
88	0.007488	0.007776	0.008064	0.008352	0.008640	
89	0.007862	0.008165	0.008467	0.008770	0.009072	
90	0.008237	0.008554	0.008870	0.009187	0.009504	

New

SKINNER DUCTILE IRON TROUGH VISES

are more rigid, stronger . . . and tougher!

● Thanks to the use of a unique new metal, ductile iron, these new Skinner milling machine trough vises have *extra* strength to resist cracking, *extra* toughness to take abuse, *extra* hardness to withstand heavy blows, and *extra* rigidity for extreme accuracy and holding power. They vibrate less, too . . . reducing scrap and tool breakage. You can expect these new Skinner D-I-T vises to hold up longer in service than any other construction and to require a minimum of maintenance.

The holding capacity of these vises is equal to the full width of the jaws. And the precision-machined jaws are rugged enough to hold work under the severest conditions. A flat, smooth body keeps chips from getting under the movable jaw. And a large trough guides the coolant to return – keeps it from slopping over. A square lock construction provides additional rigidity.

Jaw widths: 4″, 5″, 6″, 7″, 8″. Optional swivel base for setting vise at any angle through 360° in a horizontal plane.

Skinner Vises and Chucks are available nationally from leading Industrial Distributors, Machine Tool Builders and Dealers. For complete information, contact a Skinner Representative or write us at Dept. 10N

SKINNER VISES

THE CREST OF QUALITY

THE SKINNER CHUCK COMPANY • NEW BRITAIN, CONNECTICUT

Photo Courtesy Quality Aluminum Castings Company — Waukesha, Wis.

POURING "HOTS" TAKES P&H PRECISION HOISTING

Putting ladles of molten aluminum "on the spot" for careful pouring is a P&H Zip-Lift's full-time job in this foundry . . . a job it handles with a mother's care. From furnace to mold this husky hoist answers every command with a sureness that pinpoints the Zip-Lift's close-spotting ability.

P&H Zip-Lift is "safety-built" too — made to include the positive safety features needed to protect workers from harm. One-hand, fingertip control provides instant response without drift — even under capacity loads. Control current is stepped down to a low 24 volts to protect operator against electrical shock. A double-safe dual brake system stops loads immediately . . . and either brake holds the whole load even if power fails. Limit switches guard against hoist abuse . . . cut maintenance.

Pleasantly enough, Zip-Lift accuracy and safety are priced for the shrewd buyer — starting as low as $200.

If precision safety and price are your buying yardsticks, you'll want a Harnischfeger Zip-Lift. It's fully explained in Bulletin H-20, yours for free from Dept. 203, Harnischfeger Corp., Milwaukee 46, Wisconsin.

P&H HARNISCHFEGER
...quality and service for 75 years

Fully Automatic
FORGING MACHINE
DELIVERS 45 PIECES PER MINUTE!

The illustration above shows a 2" HILL ACME Automatic Forging Machine with an induction heater producing $\frac{5}{8}$" and $\frac{3}{4}$" mine roof bolts, in lengths from 12" to 72", at the rate of 45 pieces per minute in sustained operation. Bars are loaded into the feeding rack where an index feed, chain driven, positions them for proper spacing through the induction furnace. As the bar ends are heated they are delivered, at the proper timing cycle, to the forging machine by a roller chain feed where they are gauged for length, picked up by fingers and passed progressively through the dies. Finished forgings are discharged from the back of the machine by means of a separately driven conveyor, arranged for both right and left hand discharge.

The design of this new HILL ACME AUTOMATIC forging unit does not limit the number of passes or the length of stock to be used in forging a variety of parts. Pieces longer than 36" are supported by a walking beam through the various passes.

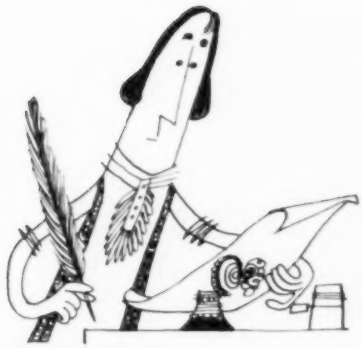
HILL ACME AUTOMATIC forging machines are built in $1\frac{1}{4}$" to 5" capacities all of which can be automated. Your inquiry concerning high speed automatic forging equipment will receive prompt attention.

The HILL ACME Company

1207 W. 65th STREET • CLEVELAND 2, OHIO

Manufacturers of: "ACME" FORGING-TAPPING MACHINES • "CANTON" ALLIGATOR SHEARS • ROTARY SHEARS • BAR-BILLET SHEARS • "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CLEVELAND" KNIVES • SHEAR BLADES • MATERIAL HANDLING EQUIPMENT

Talking Shop...



Ah, the Bard

EDITORS ARE NOT HARD, cold, mechanical critters that some readers might imagine—and here's proof, found deeply buried in the overmatter for the article on page 135. Looks as though in writing what we call the "deck," the engineer editing this article was carried away by the question it poses—to flame harden or not to flame harden. And here's what came out of his typewriter:

To flame harden, or not to flame harden—that is the question
Whether 'tis nobler in the shop to bear
The amps and volts of the induction coil,
Or to apply the flame directly to the part
And by heating harden it. To heat, to quench—
No more, and by a quench to say we end
The heat treat and the thousand thermal shocks
That steel is heir to. 'Tis a heating cycle
Devoutly to be wished. To heat, to quench,
To quench—perchance to crack. Aye, there's the rub,
For in that cracking what stresses may come
When we have finished this final quench
Must give us pause.

Automation Has Limits

DOES AUTOMATION close the door on rapid technological advance? Dr J A Morton, vice president of Bell Telephone Laboratories, thinks it would if Western Electric went to full automation on telephone-system equipment. Because automation must be applied to large quantities and run for a long time to pay off, he suggested, it should not be applied to parts on which early future improvements, or gradual continuing development, are expected.

He also predicted, speaking at WE's opening of its expanded Allentown plant, that the electronics industry may move from 5th to 3rd or 2nd place in the country in ten years or so. Transistors should surpass vacuum tubes in quantity of application by 1964 or 1965. And there is also, he noted, a whole new broad range of semiconductor materials, some of which haven't yet been tried out, that should expand the industry tremendously. Applications in the future will not be limited to communications, but may go into many other fields.

He compared telephone central-office and switching equipment to computers, noting that the whole telephone system is a giant computer far more complex than any of the new electronic marvels on the market.

Fuel Cell Tractor

THE CHEMICAL METHOD of producing electricity developed by Allis Chalmers last year is now being used to power a tractor that develops 3000 lb of drawbar pull. The research vehicle has 1008 fuel cells each $\frac{1}{4}$ in. thick and 12 in. sq. The cells when racked together take about the space of a normal tractor engine but they produce 15 kilowatts of electrical output to power a 20 hp dc motor that drives the tractor. Fuel source is a mixture of gases, mostly propane that is fed into the cells.

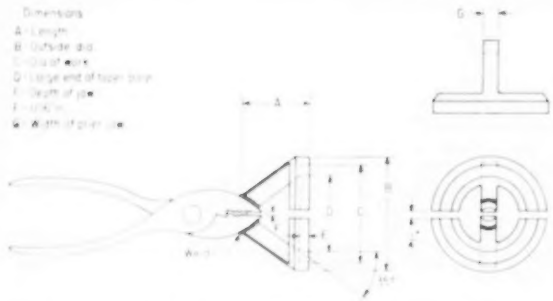
In the fuel cell the gas is adsorbed by the catalyst on the anode and reacts with the electrolyte to form a stream of electrons. At the cathode oxygen reacts with electrons coming from the anode (by way of an external circuit) to reform the ion used up at the anode. Fuel gas is consumed, you get water, carbon dioxide, and electricity. Dr H K Ihrig, research director at Allis Chalmers sees possibilities in the fuel cell to power machines some day.

Error Eliminated

FROM NOW ON gears will be produced without error—most of the time, that is. In the past the deviation from design has been called error and gear specifications have been in terms of allowable error. On virtually all other operations, we speak of tolerance. Now the gear manufacturers have embraced tolerance and we'll only hear about error when the tolerance is exceeded. This is a delightful way to improve the quality of gears (and, we confess, a reasonable one). The gear manufacturers are to be congratulated on discovering that every dimension in this imperfect world requires a tolerance.

Practical Ideas...

Special Plier Jaws Speed Valve-Insert Finishing



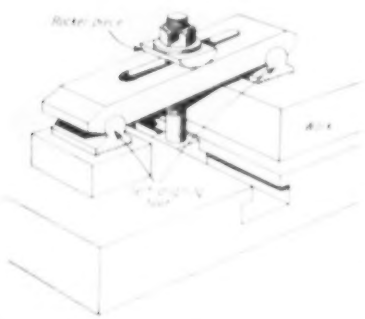
A set of quick-acting workholders, designed and made in our shop, permit thin valve rings to be held tightly against a rapidly-moving wire wheel for polishing and deburring. Since their adoption, production speed and ease of handling has improved; but what is probably more important, accidents caused by rings getting caught in the wheel has been eliminated.

The job of putting the final touches on the work is performed by the lathe operator while a cut is in progress on the next piece. This gives him ample time to pick up a piece just severed from the stock, place it in the holder and step over to an adjacent floorstand grinder for the finishing operation.

Basically, the workholders are standard pliers fitted with circular jaws made from SAE 4150 steel. They are machined in pairs and in three different diameters for a circumferential grip on rings of three sizes.

After the faces and counterbores are turned, the insides and outsides are machined at 35°. This tapered section, when the two sides have been milled away, forms the legs for welding the circular jaws to the plier jaws. The counterbored section is then split at right angle to the legs with a 1/4-in. wide saw, and after shaping the ends of the legs to the contours of the pliers, the two parts are welded to the plier jaws which are held open, at least, 1/16 in.

Clyde C Beville, superintendent, Valve Products Inc, Subsidiary of Rockwell Manufacturing Co



Straps are Self-Aligning

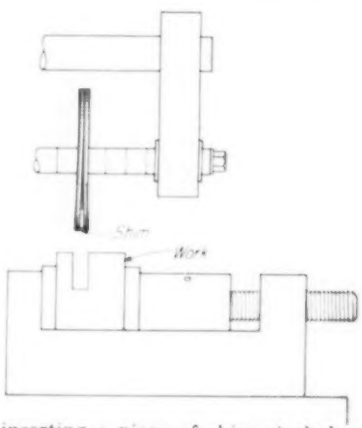
Strap clamping is considerably simplified when straps equipped with automatically-leveling feet are used. Blocking height does not have to be as critical as with standard straps, and many irregular, even tapered, parts can be held securely.

These straps are easy to make and, when properly designed, will withstand the pressure required for the regular run of work holding. The first thing to consider is the thickness of the material used. It should be heavy enough so the back of the joint socket won't be the weak points in the straps.

Sockets are made by drilling holes squarely across the straps near the ends; allowing the holes to partially break through. This operation makes it necessary to clamp a piece of scrap on the side of the strap to maintain drill alignment.

Feet are made in the shape shown in sketch; the male portion of the joint to slide fit the socket and the mounting surface serrated for a nonslip grip. They are then hardened and drawn for more strength. A rocker piece is used under the stud nut and washer to make up for tilt.

Charles H Willey, Penacook, NH



Shim Broadens Saws' Capacity

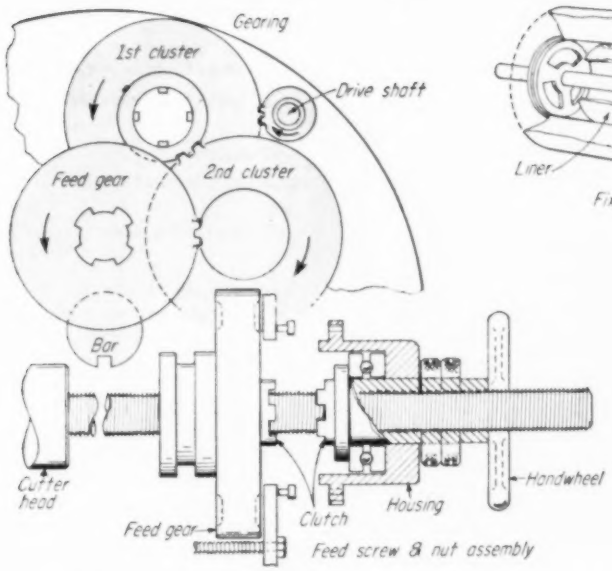
Have you ever tried ganging two slitting saws to produce a particular-size cut with one pass, only to find that you were a few thousandths short of the goal? And, did you then give up in disgust turning to grinding down an oversize cutter to the required width?

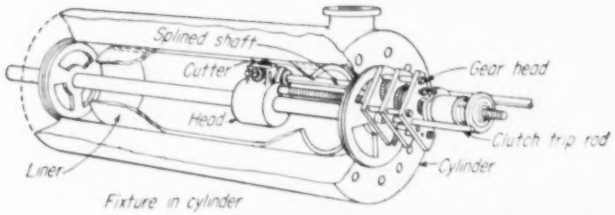
Unless it's a long-run job, this is not at all necessary. The capacity of two slitting saws, clamped side-by-side on an arbor, can be expanded by inserting a piece of shim stock between them.

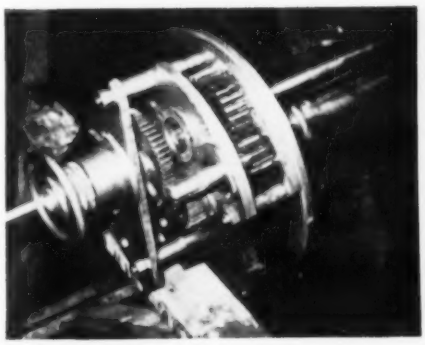
To do this, simply loosen the arbor nut enough to allow a piece of shim, cigarette paper, or cellophane to be placed between the blades just behind the teeth. Then retighten the nut and take a trial cut. If a thousandth or so more is needed, add that much to the first shim; but be careful, overloading will set up stress that may crack a blade.

Ballard E Long Jr, Knoxville, Tenn

Milling Fixture Safely Removes Cylinder Liners







To increase the capacity of their 8 compressors on the Big Inch gas line, the P. G. & E. company, in addition to supercharging the engines, decided to remove the liners from the compressor cylinders. That the cylinders had originally been precision hone after boring made this feasible without a major machining job; the problem was to get the liners out without damaging the bore.

That's where we came in. Pressing them out was out of the question; boring them out was too risky when you consider the fact that the cost of each cylinder was approximately $13,000. Following a planning session, my employer reasoned that the only safe way would be to mill them out. He then turned over to me the job of designing, constructing, and using a fixture that would be portable and could be used either vertically or horizontally. The result was the fixture shown in the illustrations.

Mainly, it consists of a bar on which rides a head carrying a milling cutter powered and fed through a gear head at one end of the bar. Two end plates, with sections cut out to reduce weight, support and locate the bar concentrically with the cylinder bore. One of these plates is affixed to the bar while the other is movable and can be located at any depth. Both are machined with two diameters; one to rest on the end of the cylinder, the other to fit inside the bore.

The gear head includes four gears, two of which are cluster gears with 2 to 1 reductions. A gear-head motor with an RPM of 230 delivers the power through a universal joint to a stub shaft of the first gear. This in turn drives the second gear which at 70.5 RPM transmits power to a splined shaft rotating an arbor in the cutter head. The second cluster gear, its large gear below a second deck and its small one above, further reduces speed as it engages the feed-screw gear. This gear is machined with a groove at one end to accept a yoke and milled with teeth into the hub of the other to form one half of positive clutch. See sketch lower left.

The other half of the clutch is on the feed nut which is also the base for the feed assembly. Into this assembly goes, in addition to the nut, a thrust bearing, a housing for mounting to a third deck of the gear head, lock nuts, and a hand wheel. Two radial slots in the housing flange makes it possible to remove entire assembly for rapid traversal of the feed nut via hand wheel. Because of the left-hand rotation of the feed gear and nut assembly, left-hand threads are used on the feed screw. This screw, being anchored to the cutter head, pulls the cutter towards the gear head shown at top right.

Bronze bearings are used throughout the gear head except on the feed screw which is guided by the bronze nut and its bossed housing. A short rod projecting on both ends of the gear head operates the feed clutch through a yoke. When pushed in, clutch is engaged; when pushed out by the cutter head, feed stops.

Cutter-head alignment is assured by a key engaging a keyway in the bar. The cutter arbor and the splined shaft are coupled by bevel gears and are supported in ball bearings. Location for the arbor is so calculated that when a 4 in. dia mill is mounted on it, a cut can be made through the liner within 0.010 in. of the cylinder bore. We used a ¼-in. wide staggered-tooth cutter running at 47 RPM with 1/32-in. feed per revolution. After completing 28 cuts, ½ in. deep and 38 in. long, the mill was still good for many more without ever having been resharpened.

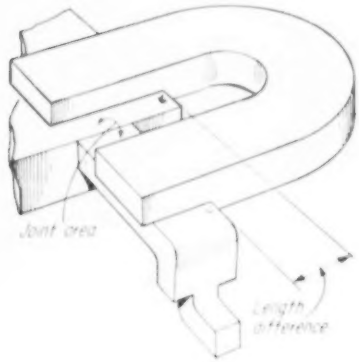
To install the fixture, the cutter head is first moved to the far end of the bar. The back end plate is then removed and after the fixture has been inserted in the cylinder, both end plates are positioned and secured using the cylinder-head studs to hold straps.

Four cuts are made through the liner; two within 1 in. of each other

Practical Ideas...

and two about 120° from the first two. A narrow strip that can easily be knocked out is thus produced with the first two cuts permitting removal of the remaining three sections. For each cut, the cutter head must first be moved to the far end; after that it's only a matter of loosening the straps, rotating the fixture and again securing it. A light touch with a hone to polish the cylinder, once the liner is out, completes the job.

Roy Milburn, foreman, Bud Blair, president, Blair Iron Works, Coalinga, Calif



Magnet Holds Parts For Assembly

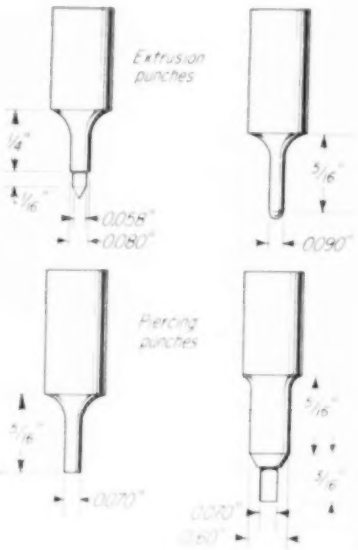
Locating and holding a small steel tab for silver soldering to a steel plate is greatly simplified with a magnet. In use, the magnet is placed with one pole on the plate and pushed up against the shoulder. The tab is then placed on the other pole, against its shoulder, and slid up to the plate.

Because the tab and the plate are in effect opposite magnetic poles, they are attracted to each other forming a rigid assembly. This assembly is thus held in alignment while the joint area is heated with a torch and silver soldered. And, as long as the magnet is not heated above its Curie temperature, it will hold the steel parts in place.

The fixture is accurate and offers convenient access to the joint area though it's very simple in design. Made from a common horse-shoe magnet, two surfaces are ground flat on the same plane, but with different lengths. This difference is equal to the dimension the outer edge of the tab must be from the plate's edge.

Parts other than those shown can as conveniently be held by modifying the holding and locating surfaces on the magnet. For continuous production, an electro-magnet may prove more versatile as the size, shape, and orientation of the poles can more elastically be arranged.

Ivan Garshelis, Clark, NJ



Carbide Cuts Drill Blanks

Although we buy most of the punches for our dies, we, like many other people, make our own in emergencies. However, these punches are not as good as the commercial product even though they're made of oil-hardened steel or drill rod and carefully machined. At least, this was our opinion before we tried making them out of drill blanks.

But how do you go about making punches out of this tough material in its natural state except by grinding? We found that this could be done as a regular turning job using a T-483 cemented-carbide tool which has a 3° negative rake and a 5° clearance angle. In addition to following the tool manufacturer's recommendations as to spindle speed, a fine job can be done if vibrations are eliminated in both the work and the toolholder. And, under no circumstances should this work be attempted without the use of safety goggles.

Charles Sarruda, Quincy, Mass

Hjalmar Dahl
Upplands Vasby, Sweden

WON

$25 **In addition to regular payment for his idea:**

COMBINATION DIE OVERCOMES SPRINGBACK

in the Sept 21, 1959 issue

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JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

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HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N.Y.

New Shop Equipment

Materials and Parts

Rotary-Table Miller for Non-Ferrous Use Said To Have Rigidity of Bed Type Unit

Rotary-table milling machine for non-ferrous face milling has a combination of high speeds and fast feeds with construction as rigid as a bed-type machine. Basic machine has a single vertical head. A second head can be supplied for single-pass milling on such operations as roughing and finishing, face milling and profiling, and milling at two elevations. Machine illustrated, Model MM-48 Mach-Mil, is the first of a series of face millers to be introduced by Onsrud.

The milling head is adjustable vertically from 2 to 15 in. above the table and is mounted on a movable column which permits it to be positioned from 12 to 28 in. from the center of the table. Available heads include a 10-hp, 3600-rpm model.

The 48 in. diameter table is mounted on large preloaded anti-friction bearings which carry the radial load and most of the vertical load. A second bearing is located at the outside edge of the table to assist in carrying the axial load and prevent any table deflection. Standard rotary table drive provides an infinitely variable peripheral feed rate of 18½ to 150 ipm. Optional table drive provides feed rate of 37 to 300 ipm.

The rotary feed table is claimed to be advantageous because the feed motion is continuous, no production time is lost for loading and unloading, cutter is not dragged over the finished surface on the return stroke, high table feeds can be used, and multiple operations can easily be performed on one pass when using a second head.

To make the machine as rigid as possible, components such as the bearings, the table-bed and column assemblies, the table drive mechanism, and the assemblies for adjusting and holding the milling head were specially designed for heavy duty performance.

Onsrud Machine Works, Inc, 7712 Lehigh Ave, Niles 48, Ill

MORE DATA? Circle 51, inside back cover

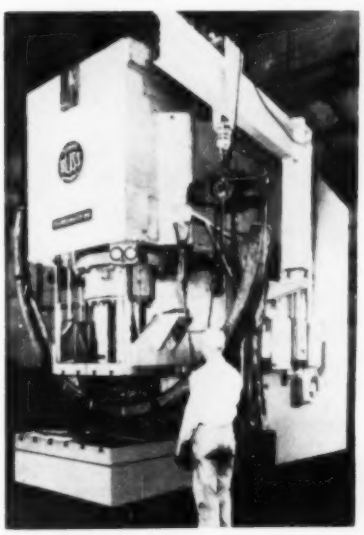
Torsion Testing Machine Features Electronic Load Indication

Low-capacity ElecTomatic Lo-Torq unit is equipped with variable speed range from 5 to 180° per minute; speeds can be selected and maintained by a variable speed electronic motor drive. Torsional loads are indicated on a 28-in. SelecTorange dial which is provided with four range capacities. Operator can change ranges as desired during the test.

Currently available with a capacity of 10,000 in.-lbs, this bench model machine will handle specimens up to 1 in. in dia with a max length of 24 in. An electronic stress-strain recorder can be furnished for making a complete record of the entire test on a large chart.

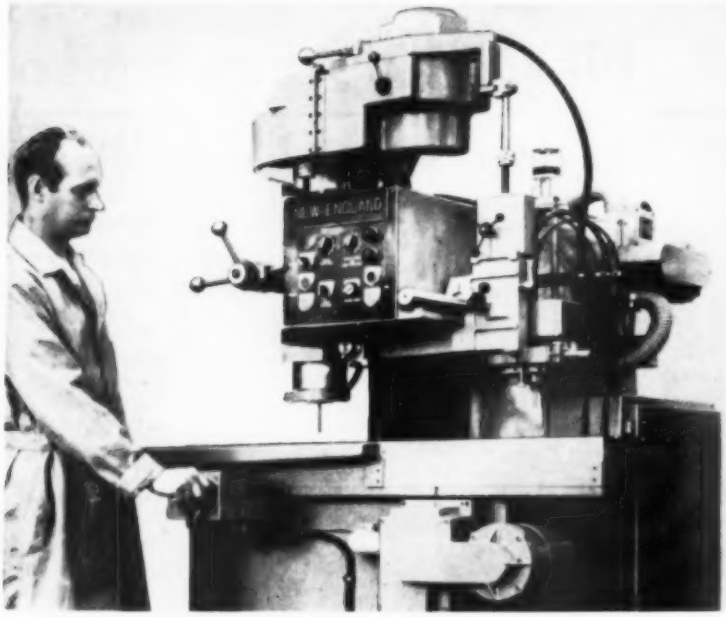
Tinius Olsen Testing Machine Co, 250 Easton Rd, Willow Grove, Penna

MORE DATA? Circle 52, inside back cover

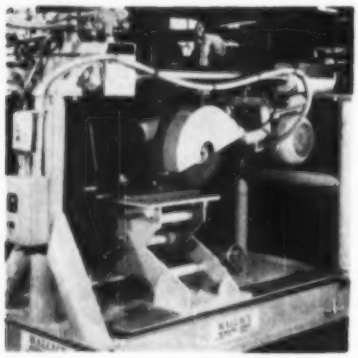


LADLE RIMS, 48 ft around are formed out of bar stock 7½ in. sq and 24 ft long in this 800-ton hydraulic gap frame press. Double-acting ram has 36 in. stroke and 17 ipm pressing speed. Throat depth is 60 in., ram plate 48 x 48 in., bolster plate 72 x 84 in.—*E. W. Bliss Co, 1375 Raff Rd, SW Canton 10, Ohio*

MORE DATA? Circle 53, inside back cover



Tracer-Controlled 360° Profiler Reported To Have Speed, Accuracy of Plain Miller



Milling machine, designed and built specifically for 360° profile milling under tracer control, is reported to reproduce complex, irregular two-dimensional shapes with the speeds, feeds, and accuracy usually associated with precision plain milling operations.

Tradenamed the Magnetrace Automatic Profiler, the machine operates by following a sheet metal templet. All backlash has been eliminated in the slide motions and table and cross-head drives are activated by a stylus deflection of 0.0002 in.

The Magnetrace is equipped with a 5-hp spindle drive and seven speed changes with a range of 375 to 5200 rpm. Tracer follows the templet at a constant pre-set speed of up to 80 ipm. According to the manufacturer, many jobs previously requiring roughing and finshing cuts can be completed in a single pass.

Only tooling required is a work-holding fixture, steel templet and a tracer stylus the same diameter as the cutter. Cutter and tracer are aligned by micrometer adjustment. The profiler can easily be adapted for automatic cycling.

The machine is made by New England Machine and Tool Co, Berlin, Conn, and sold by Pratt and Whitney.

Pratt and Whitney Co, Inc, West Hartford 1, Conn

MORE DATA? Circle 55, inside back cover

Oscillating Abrasive Cut-Off Machine Cuts Large Sections

An oscillating-type abrasive cut-off machine for large steel sections is available in three sizes: a 20-in. wheel with 15 hp for dry cutting with a 24 in. stroke; a 26-in. wheel with 20 hp for dry cutting with a 30 in. stroke; a 3½-in. wheel with 40 hp for wet cutting with a 36 in. stroke.

The manufacturer claims very high finish and cutting speed, citing cases where cut surfaces have less than a 50 microinch finish and 60-lb-per-ft sections have been cut in one minute. Traverse feeds are vernier controlled.

Wallace Supplies Mfg Co, 1304 W Diversey Pkwy, Chicago 14, Ill

MORE DATA? Circle 54, inside back cover

Thermal Dynamics Offers 30,000 F Plasma Jet Units

Plasma jet equipment is offered for production of hot gas streams to 30,000 F. Operating costs are said to be half of those of an oxygen flame and life of the equipment 50 times that of similar apparatus.

Standard plasma sets ranging from 12 to over 1000 kw are available as individual components or complete chamber-vacuum systems.

Industrial applications include chemical synthesis; high temperature materials study and manufacture; high temperature heating; metal processing, spraying and welding; aerodynamic heating; ion, free radical and propulsion studies.

Thermal Dynamics Corp, Hanover, NH

MORE DATA? Circle 56, inside back cover

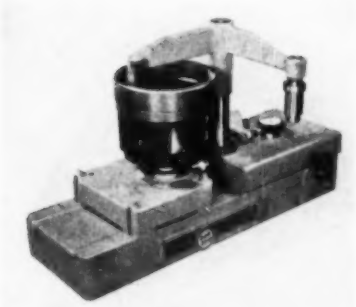
Cramer Air Staker Presses and Stakes

Unit that is basically an arbor press with a staking feature performs pressing or staking operations independently or combines them in rapid sequence for faster, lower-cost assembly of small components. Finished assembly from primary components is often as fast as from pre-stocked subassemblies, manufacturer claims.

Dieset accuracy is achieved because fit of the tools is within 0.001 and the platen is machined square to the work line. Staking is accomplished by the impact of a tool steel piston rod inside the arbor press ram, which serves as an air cylinder. Because air pressure is vented before impact, every blow is identical, producing uniform assemblies. Force of the staking blow is adjustable by a pressure regulator on the air valve, from 15 psi to line pressure. In heavy pressing operations, operator holds the piece down with the arbor press and delivers a series of light blows to the hold-down punch with the air hammer.

Cramer Controls Corp, Centerbrook, Conn

MORE DATA? Circle 57, inside back cover



Red Ring Gear Rolling Fixtures Adapted to Check Internal Gears

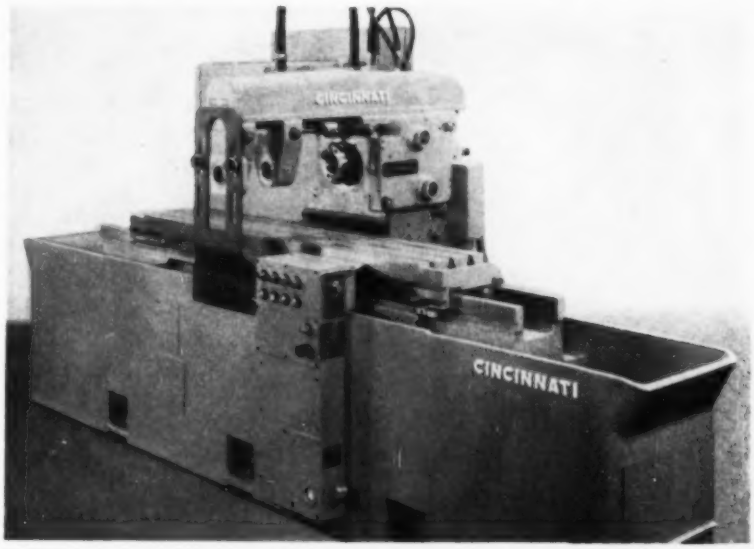
New line of Red Ring Model GRB gear rolling fixtures have been adapted for checking internal spur or helical gears. The fixtures have a 27-in. long by 8¾-in. wide cast iron base.

The movable slide unit at the right carries the master gear mounting and the indicator which shows center distance variation resulting from errors in the gear being checked. This slide is spring-loaded and travels on ball bearings. A lever at the front moves the slide to engage the master gear with the work gear mounted on a fixed base at the left.

Fixtures can be designed to handle a variety of gears. If the internal gear cannot be entered from the bottom, the master gear is supported on an arm unit on a post. Two arms may be used to check gear tooth runout and minor diameter runout with the same gage—one arm carrying the master gear the other a relieved flat gage unit.

National Broach and Machine Co, 5600 St Jean Ave, Detroit 13, Mich

MORE DATA? Circle 58, inside back cover



Cincinnati Introduces 100 and 200 Series Hypowermatic Bed Type Milling Machines

Cincinnati 100 and 200 Series Hypowermatic milling machines feature heavy, rigid construction with hydro-mechanical table drive and Dynapoise overarm vibration dampening for chatter-free metal removal at hign rates.

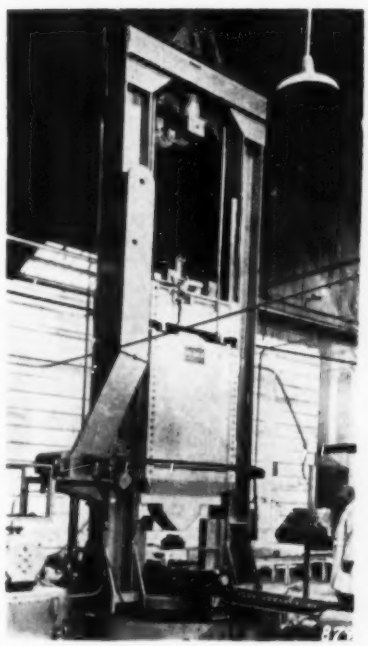
Mills are available in plain or duplex models and can be furnished with either automatic rise-and-fall spindle carriers or with tracer controlled spindle carriers. Table widths are 12 in. for the 100 Series and 15 in. for the 200 Series. 12-in. tables are available in four lengths from 59 to 83 in. and 15-in. tables come in four lengths from 71 to 107 in. Feed rates are infinitely variable from 1 to 150 ipm. Rapid rate is 300 ipm.

All spindles have 16 speeds with speed changes by means of pickoff gears. For the 100 Series there is a standard 7½-hp spindle with a 40-1600 rpm range and an optional 5-hp spindle with 30-1200 rpm range. For the 200 Series, a 10-hp 50-2000-rpm spindle is standard. A 7½-hp spindle with 30-1200 rpm is optional and a 15-hp spindle with 75-3000 rpm is available at extra cost.

Tracer-controlled Hypowermatics are equipped with new Telematic control (*AM*—Oct 19, '59, p188). Hydramech table drive places the driving force almost directly under the spindle by using a variable speed motor driving dual pinions.

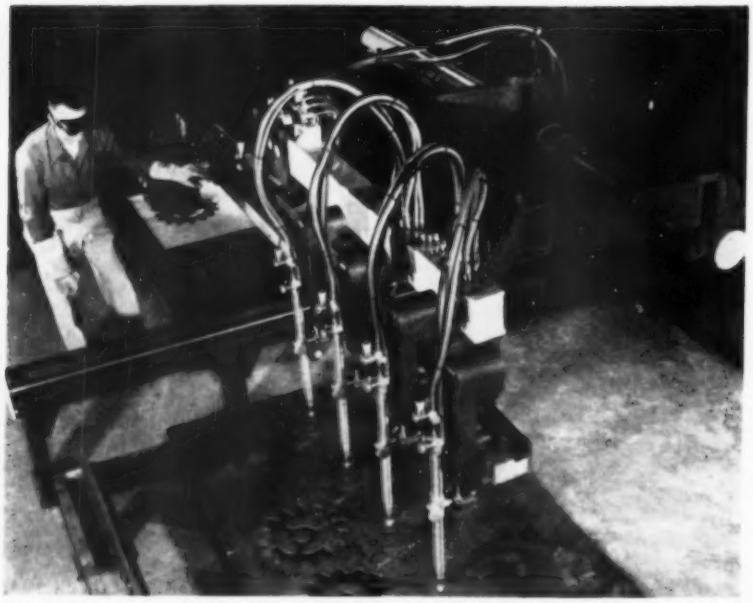
Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 59, inside back cover



CASTING CONDITIONER is used to build up initial capacity in a railroad car draft gear by dropping a 27,000 lb weight from successively increasing heights of 2 to 12 in. The unit forms coined surfaces on the rough cast follower wedge, friction shoes and draft gear housing to provide perfect mating surfaces—*American Steel Foundries, Elmes Engineering Div, Cincinnati 29, Ohio*

MORE DATA? Circle 60, inside back cover



Eight-Foot Capacity Cutting Machine Has Pantograph Design, Centralized Controls

Shape cutting machine, equipped with four motorized torches and an eight-foot capacity, is reported to be first cutting machine with pantograph design.

Designed for medium duty shape cutting, the Linagraph's four torches use acetylene, propane or natural gas. It can shape or straight-line cut anywhere within a rectangle eight-feet wide and of a length determined only by the number of rails and tracks used. The tracing area is provided with a movable templet-top measuring 4 by 8 ft.

All controls for gas pressure, motorized torches, machine carriage, and tracing device are located directly above the tracing table within easy reach of the operator. This centralized system is said to simplify over all operation and cut down on the floor space needed to install the machine since both the tracing area and the machine carriage occupy the same space. Unit includes carriage, tracing table, controls, torches, structural parts and 20 ft of track. It is powered by a 110-v ac motor.

The Linagraph can be set up for either left-hand or right-hand operation and can be equipped with manual, magnetic or electronic tracing units.

Air Reduction Sales Co. Div of Air Reduction Co, Inc, 150 E 42nd St, NY 17, NY

MORE DATA? Circle 61, inside back cover

Automatic Cycle Cutter Grinder Features Automatic Wheel Truing

Automatic cutter grinder features automatic cycle, including wheel truing, to enable the operator to sharpen his own cutters while maintaining milling machine production. Both plain and stagger tooth cutters can be ground.

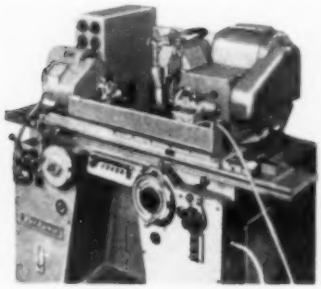
A variable torque motor indexes the cutter into position against the toothrest. A second torque setting establishes proper pressure between cutter tooth and toothrest for smooth feed of the helix during the grind. To assure concentricity, the automatic cutter grinder is equipped with a counter to permit 180° rotation of cutter after the first rough grind revolution.

The control panel has counters which program: Number of rough grinding revolutions of cutter, number of finish revolutions, number of cutter teeth, 180° rotation for concentricity, number of teeth for roughing pickfeed, finish pickfeed, teeth ground between wheel truings, number of truing passes.

On the truing device, the diamond advances 0.001 in. per pass. For each pass, the saddle pickfeeds 0.001 in. to compensate. The saddle, operating on ball tracks, can be set to pickfeed between 0.00025 and 0.005 in. in increments of 0.00025 in.

Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 62, inside back cover



Cylindrical Grinder Line Offered For Traverse and Plunge-Cut Work

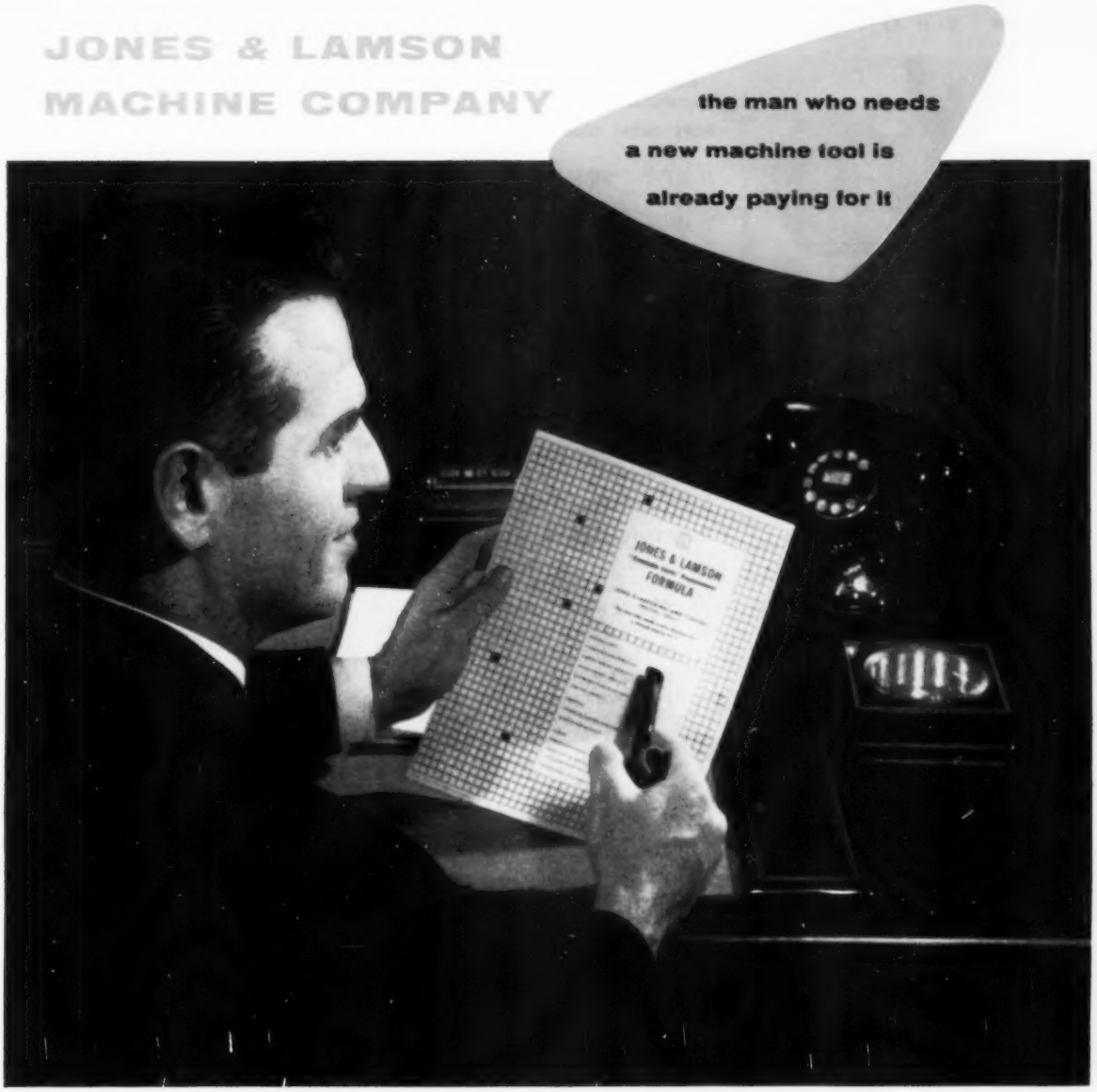
New Fortuna AFB Series (German) is available in 16 types ranging from a plain manually fed unit to fully automatic cycle control models. Designed for traverse and plunge-cut grinding, they are easily adapted to internal grinding of single or mass produced workpieces. Multi-diameter pieces, fillets, faces, and tapers can be ground in one operation.

Features include hydraulic table traverse with infinite speed variation between 2 in. and 26 fpm; two-speed table traverse handwheel; easily adjusted table dwell; and smooth accurate table reversal to within 0.0004 in. Workpiece holder table swivels for taper grinding, and has a dial gage and stop for angular settings. Built-in controls pre-select traverse speed for grinding and wheel dressing. Rough and finish grinding are controlled through the Finitor, an automatic sizing device that controls the in-feed of worktable by continuously measuring the workpiece, eliminating the effects of wheel wear.

Distributed by Cosa Corp, 405 Lexington Ave, New York, NY

MORE DATA? Circle 63, inside back cover

JONES & LAMSON
MACHINE COMPANY



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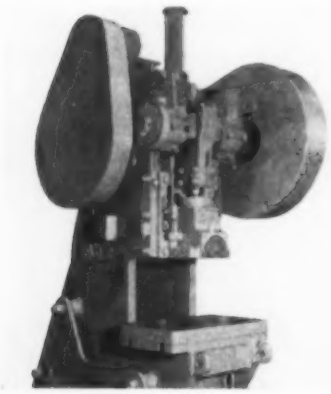
Using the J & L Formula, you get a realistic, reliable picture of production performance, something you can really hang your hat on. It gives you the means of proving to management the vital importance of modernizing plant equipment. And the figures you can produce are both valid and realistic, because they allow for the inflation spiral of equipment costs, as well as rising labor rates.

We'll be glad to supply you with a copy of the J & L "Avoidable Costs" Replacement Formula, together with some easy-to-use work sheets. Write today to Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



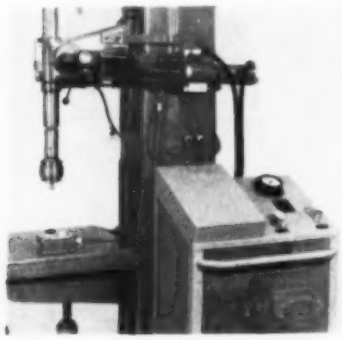
Niagara Modernizes Line of OBI Presses

Modernized Series A OBI press line, with multi-point mechanical sleeve clutch, is available in 13 sizes with 1¼ to 6½ in. shaft diameters and 5½ to 190 ton capacities.

The solid slide casting has been moved forward to provide solid backing for the dies. Flat surfaces on the front and sides simplify fitting attachments to the machine. Multiple V gibs assure accurate alignment, balanced loading and greater guiding surface. Also included are an air power inclining device, split belt guard for raising or lowering the slide, and quick adjusting friction clamp knockout rods.

Niagara Machine and Tool Works, Buffalo 11, NY

MORE DATA? Circle 64, inside back cover



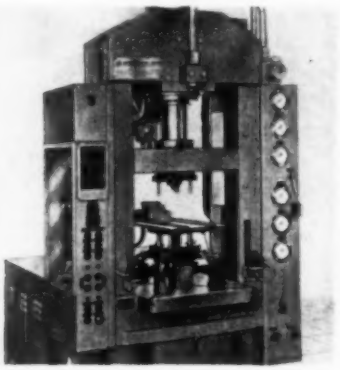
Self-Contained Hydraulic Feeds Automate Heavy-Duty Drillpresses

Packaged units provide an economical means of automating older types of large drillpresses with capacities up to approx 1½ in. in steel for high production drilling and allied work.

Unit consists of a heavy-duty power transmission arm and a wheel-mounted console that houses the control valves and hydraulic tank and pump. Beckett Hi-Cyclic hydraulic solenoid valve control system used provides a completely variable and quickly adjustable approach speed, slow-down for work entry, return speed, and working thrust. Precision limit switches and the extremely fast reaction of the valves provide reliable depth control.

Beckett-Harcum Co, 985 W Locust St, Wilmington, Ohio

MORE DATA? Circle 65, inside back cover



Hydraulic Compacting Press Molds Complex Metal Parts

Bussmann-Simetag hydraulic press is designed to compact complex shapes from powdered materials. Available in capacities from 60 to 200 tons, the press consists of a welded steel frame, two cast steel tables, upper and lower hydraulic cylinders, hydraulic pumps, and an electro-hydraulic control system.

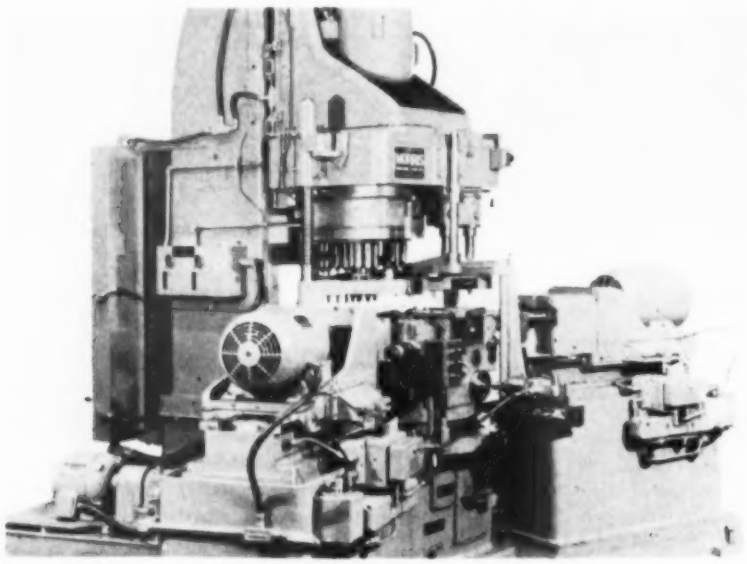
Pressing can be done by two methods: the ejection method by which the lower punch determines the depth of powder fill and moves upward after the pressure has been applied to push the compact out of the die; the withdrawal method by which the compact is pressed with a floating die and stationary lower punches and the die is pulled down over the lower punches to free the compact.

Features include: variable pressure dwell up to 60 seconds, two ranges of operating pressures with separate controls, device which changes rapid unloaded cylinder movements to slower loaded movements, delayed return stroke to allow the upper cylinder to rest on the compact until the die has been stripped.

Specification ranges for the various models include: 11.8 to 19.7 in. upper ram stroke, 4.72 to 7.87 in. filling depth, 9 to 16 spm, 29.5 to 39.4 in. maximum daylight, 7.9 to 11 ft total height.

Distributed by Mannesmann Meer Inc, Powder Metallurgy Engineering Div, 900 Line St, Easton, Penna

MORE DATA? Circle 66, inside back cover



AIR COMPRESSORS have 34 operations performed on them automatically through a 2-cycle process by Model 312-S High Production Machine that incorporates a 26-spindle vertical drill unit with clusters operating at both load and transfer positions of four different stations. Vertical column indexing machine utilizes a 30-in.-dia table and a 5-station automatic hydraulic index. Production rate is 180 parts per hr at 80% efficiency—*Morris Machine Tool Co, 2011 Eastern Ave, Cincinnati 2, Ohio* MORE DATA? Circle 67, inside back cover

JONES & LAMSON
"AUTOMATION"

the man who needs
a new machine tool is
already paying for it

Numerical Control . . . what's it worth?

What *about* numerical control: is it all it's cracked up to be? The answer, in a word, is "yes". Here's why. With numerical control, the *big* factor is *flexibility*. Tape or numerical programming can be employed economically for medium or small lot production, even down to *single pieces*. Accuracy is also increased. For instance, Jones and Lamson tape controlled positioning units hold tolerances of ± .001 on applications for punching, drilling, boring or similar operations where point-to-point positioning is mandatory. Machine set-up and change-over become primarily an office procedure. Numerical control of machining operations eliminates the need for cams, templates, even prototype parts and special fixtures. It results in greater machine utilization, and speeds actual machining. Lead time is reduced, and because human error is largely eliminated, accuracy is improved.

Any way you look at it, numerical control has come of age. It's being used more and more, simply because it produces better, at lower costs. For detailed information, write Jones & Lamson Machine Company, Dept. 710, 502 Clinton Street, Springfield, Vermont.

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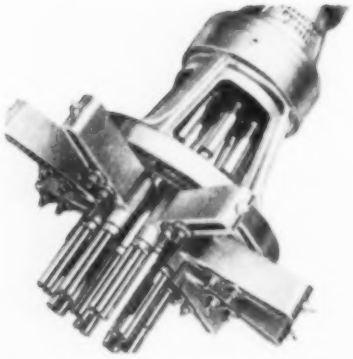


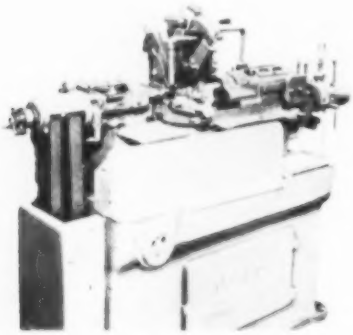
Heavy-Duty Multi-Spindle Drill Head Has 5/8-Inch Capacity

Model 98-X Hercules multiple spindle drill head, designed for heavy-duty use, has a maximum capacity of nine 5/8 in. drills in mild steel. Maximum center distance of spindles is 7 3/8 in.; minimum is 1 in. When used for multiple hole tapping, the head has a capacity of nine 1/2-in. taps in mild steel.

Two precision milled T-slots provide positive locking of the adjustable arms and give added support to the arm when under load. Head has a 1:1 gear ratio and is recommended for speeds to 2500 rpm.

Cleveland Pneumatic Industries, 6¼ Old Orchard, Skokie, Ill

MORE DATA? Circle 68, inside back cover



Swiss Automatic Lathe Features 10,000 rpm Speed, ½-in. Capacity

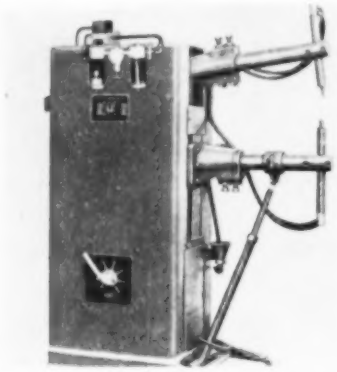
Tornos R-125 automatic lathe (Swiss) features spindle speeds up to 10,000 rpm and stock capacity up to 1/2 in.

It has guided attachment seats, instantly adjustable micronic headstock bearings, single lock toolposts, and wide variety of second operation accessories.

Specifications include: Turning length in one chucking, 2 3/4 in. plate cam, 4-in. bell cam; maximum threading diameter, 5/16-in. steel, 1/4-in. brass; 28 spindle speed changes, 40 cam shaft speeds for each spindle speed; 2.5-hp motor.

Dist by Carl Hirschmann Co, Inc, 30 Park Ave, Manhasset, LI, NY

MORE DATA? Circle 69, inside back cover



Rocker Arm Resistance Welders Offered in Improved Models

Available in both air-actuated and foot-operated models, the new Electroweld Rocker Arm machines have kva ratings of from 10 to 75, and throat depths ranging from 12 to 36 in.

Features include nylon trunnion bushings; contact switches that do not require adjustment regardless of setup changes; and heavy-duty frames. Timing sequence and heat adjustments provide for high-speed resistance welding of all types of weldable metals.

Universal Electroweld Div, Electric Arc Inc, 152-1 Jelliff Ave, Newark 8, NJ

MORE DATA? Circle 70, inside back cover

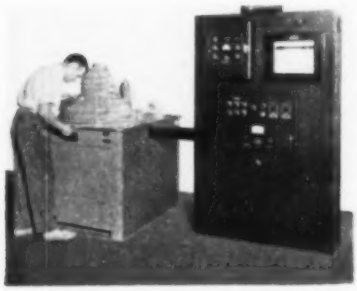
Opto-Metric Introduces New Model Of Wilder Small Parts Comparator

Model C is designed for rapid inspection of mass produced parts with stage and screen placed so as to provide maximum speed and comfort in inspection.

Instrument is furnished with basic equipment only. Variety of magnifications, measuring stages, and master gage charts are available for a range of types and sizes of parts to be inspected. Picture shows the comparator equipped with a special 2 x 4-in.-range measuring stage with window reading micrometers in 0.0001 in.

Opto-Metric Tools Inc, 137 Varick St, New York 13, NY

MORE DATA? Circle 71, inside back cover



Vacuum Heat Treating Unit Incorporates Forced Cooling

Series VVFC automatic high vacuum cold wall furnace has work space 10 in. in diameter and 14 in. deep; max operating pressure of 0.1 micron Hg; input of 25 kw; max operating temperature of 2500 F. Unit is adaptable for high temperature copper or nickel brazing of stainless assemblies. Other uses include vacuum annealing, special tool steel hardening, tempering, and drawing of refractory metals, reactive metals, stainless and special alloy steels.

Furnace and vacuum system, including roughing pump and diffusion pump, are housed in one unit occupying floor area of 42 x 48 in.; separate control panel with strip chart temperature recorder and reactor takes up 48 x 16 in. Furnace employs low voltage graphite heating elements. Special top and bottom shields serve dual purpose of confining heat and acting as directional baffles for forced convection cooling.

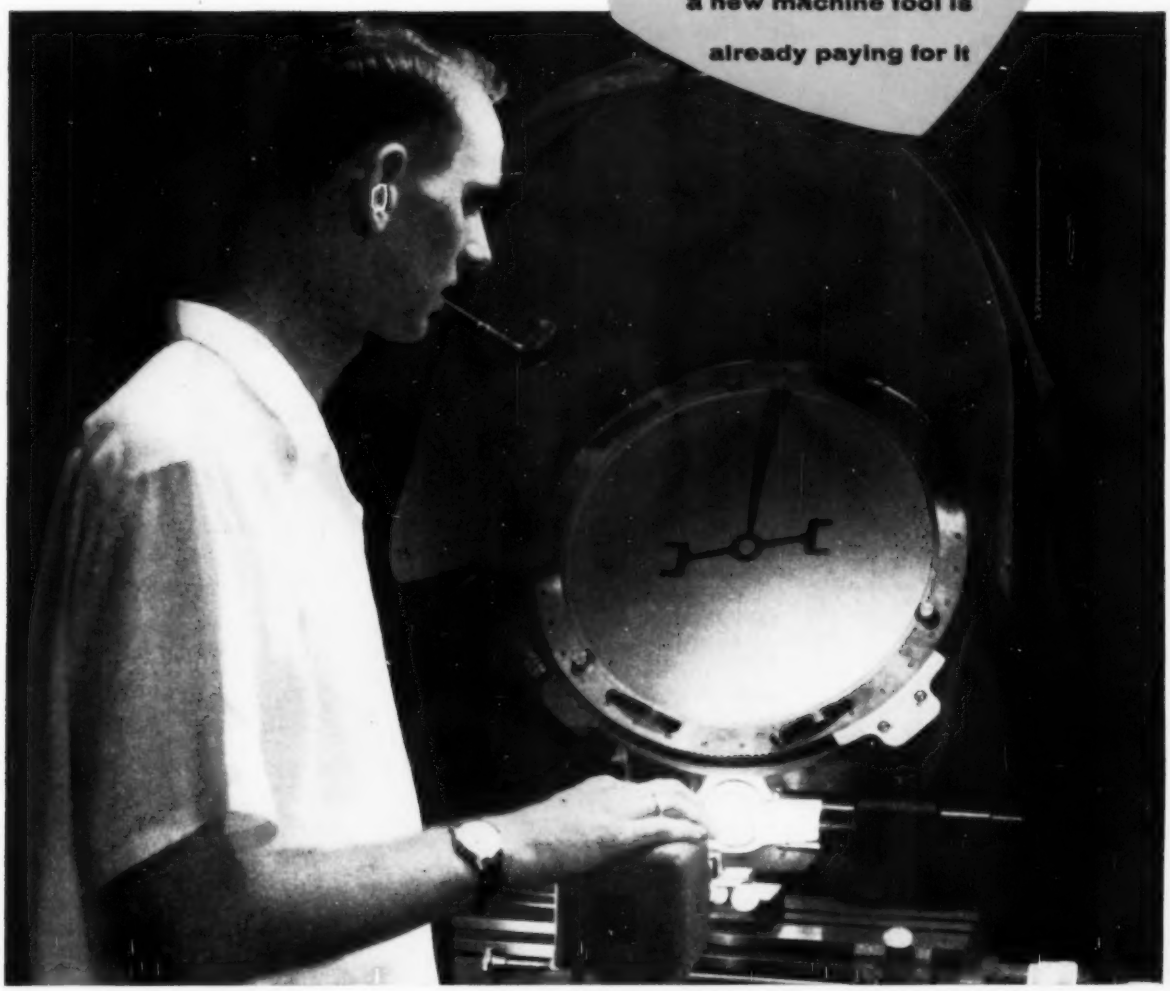
Switch on the control panel allows the furnace to be set for either manual or automatic operation as selected by the operator. Entire heat treating sequence, including time at temperature and cooling cycle, can be preset and then operated automatically by pressing a cycle start button. All operations, or any single operation, can be changed from automatic to manual at any time during the sequence.

Ipsen Industries Inc, 715 S Main St, Rockford, Ill

MORE DATA? Circle 72, inside back cover

JONES & LAMSON
OPTICAL COMPARATORS

the man who needs
a new machine tool is
already paying for it



This Comparator Paid for itself in less than a week!

At Ace Electronics Associates, Inc., Somerville, Mass., an alert management cut costs, increased production and improved product quality through speedy, precise inspection methods using a J & L Optical Comparator.

At Ace, precision of manufacture is of paramount importance. This young, progressive company, manufacturer of linear and non-linear potentiometers and electromechanical devices, including Acepot and Acetrim, insists that each and every product made in its plant give 100% reliability in the field. The aim is to not only meet, but to surpass its customers' most exacting specifications. This is being done consistently on every piece, every day.

Through stringent quality control procedures tailored to meet unique tolerance problems, manufacturing methods have been constantly improved, costs have been cut to the bone, production has reached new high levels, and product reliability is superb.

Ace gives much of the credit for this record to the Jones & Lamson Optical Comparator, which is their most important measuring and inspecting tool.

Write for new Comparator literature. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

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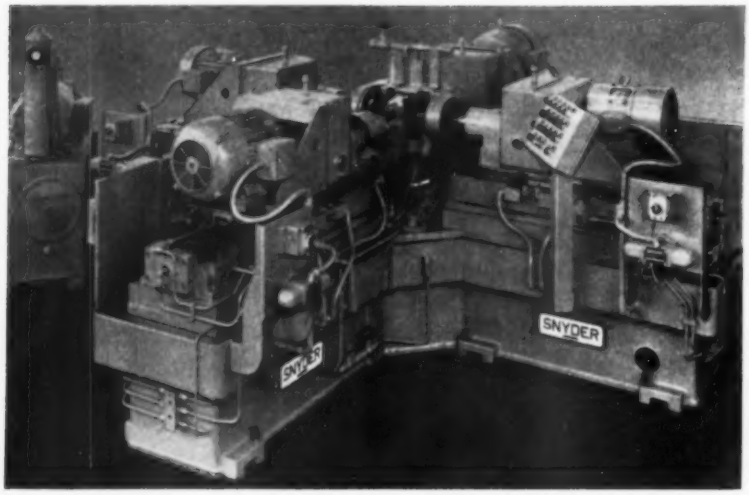
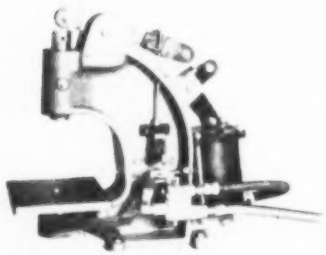


FOUR-WAY BORING MACHINES can be adapted to perform either rough or semi-finish boring operations on pinion and differential bearing surfaces of cast iron automotive differential carriers. Output is 97 pieces per hour at 100% efficiency on either operation—*Snyder Corp, 3400 E Lafayette St, Detroit 7, Mich*

MORE DATA? Circle 73, inside back cover



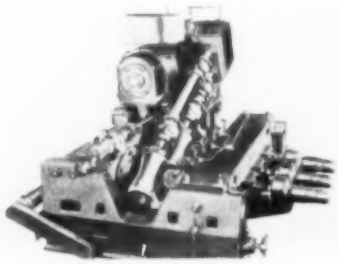
Bench Press-Riveter Delivers 2-ton Force With 100-psi Shop Air

Model DBJ has a 15/16-in. stroke, 4-in. throat, and operates at approx 200 strokes per minute. Increased efficiency results from design of its toggle power cam and a piston-type cylinder that achieves a cushioning effect without any cushion by means of a mechanism that releases the cylinder pressure to atmosphere at the top of the stroke and automatically returns the machine to its starting position. This enables the air cylinder to utilize the max force of its compression without the usual loss in efficiency occurring in cushion-type cylinders. Release valve is a metering-type unit that allows controlled application of the plunger to the work.

For industrial use, model is equipped with a bedplate as standard, permitting use of die shoes, bending forms, and other fabricating tools for ligh assembly, punching, marking, trimming, straightening, swaging, broaching, crimping, flaring, or pelleting. It can handle tubular steel rivets up to and including $\frac{1}{4}$-in. size.

Trio Machine & Mfg Co, 35690 Vine St, Willoughby, Ohio

MORE DATA? Circle 74, inside back cover



Sutton 5-Roll Straighteners Available for Heavy-Duty Work

New heavy-duty machines, designed particularly for precision straightening of large diameter bars, are capable of high-production processing of hot-rolled steel bars and alloy heat-treated bars, including drill collar stock.

Sutton 5-roll principle of straightening is employed. A central pressure roll is located between two sets of opposed rolls, each set having one driven roll and one idler. As the straightening load is distributed over three points, maximum work per pass is accomplished resulting in quality end-to-end straightening. All controls are accessible; all major adjustments are motorized and are operated from a control pulpit. Indicating dials showing roll adjustments are clearly visible to the operator who is able also to observe the straightening operation in the pass line at all times.

Sutton Engrg Co, First National Bank Bldg, Pittsburgh 22, Penna

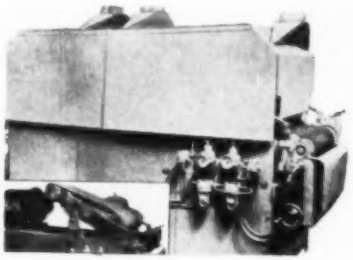
MORE DATA? Circle 75, inside back cover

Torsion Spring Test Unit Has 100 Inch-pound Capacity

Fixture for rapid testing of torsion springs features interchangeable arbors and 360° protractor. Additional arbors for special springs can be supplied. Tester uses a torque wrench as a sensing element, with a range of inch-grams to 100 inch-pounds. The basic unit can be used for direct torque testing of such items as small torque screw drivers.

PA Sturtevant Co, Addison, Ill

MORE DATA? Circle 76, inside back cover



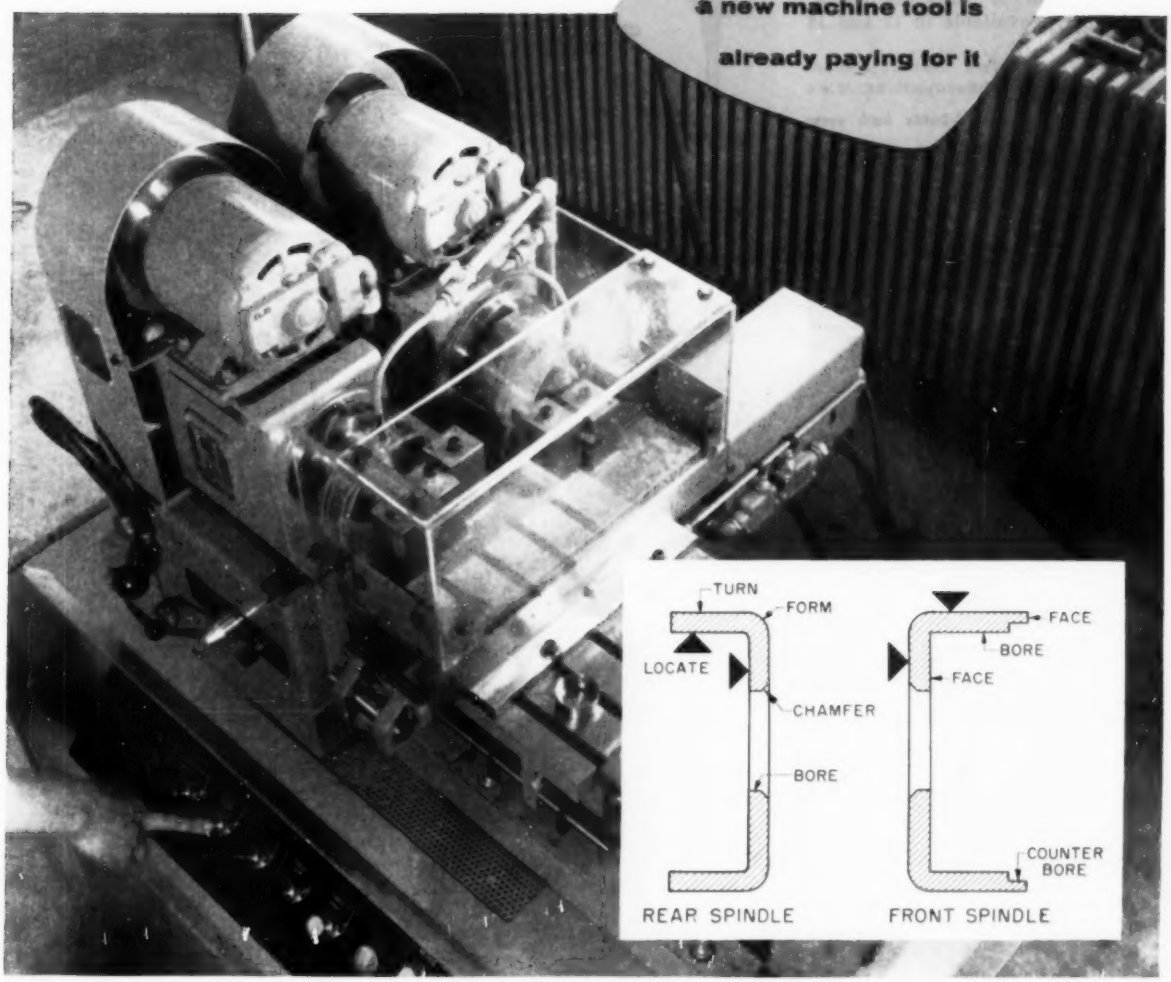
Polisher Handles Strip Stock, Sheets, Extrusions, Stampings

Speedbrite polisher is a dual head machine using a wide abrasive belt and a 3-M Scotch-Brite wheel (inset shows heads with hood raised). It can be used for polishing metal sheets, flat stampings, extrusions and strip stock.

Material is fed onto a conveyor belt that passes under both heads. The abrasive belt sanding head, mounted forward in the unit, removes scratches and scars in the metal and the rear-mounted buffing

JONES & LAMSON
MACHINE TOOLS

the man who needs
a new machine tool is
already paying for it



Two machining operations in One 20-second cycle!

For less than $10,000 (including tooling) this J & L Twin-Spindle Precision Boring Machine does a whopping amount of work. In fact, in a single 20-sec. machining cycle, both the inside and outside surfaces of these stainless steel cups are completely machined.

The part is faced, the O.D. turned, a radius formed and the smallest hole bored and chamfered while being chucked in the rear spindle. *At the same time*, the front spindle carries another piece which has been turned around. Here the inside is faced, bored and counterbored. In effect, two operations in one machining cycle.

But that's not all. The J & L Precision Boring Machine has great versatility and accuracy. The standard spindles have a threaded nose that accepts all standard air, or manually operated, chucks. They also have an inside taper to accommodate 5C collets. Tooling combinations can be either spindle or cross-slide mounted, and can be quickly shifted for long or short runs. Operation is fully automatic.

Write for our new catalog. Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

head does the polishing. The abrasive head has a floating action that can be adjusted to fine tolerances to control stock removal.

Unit has hydraulic adjustments for pressure and is fully automatic. Model SB is available in 12 and 18 in. widths.

Timesaver Sanders, Box 7446 Robbinsdale Station, Minneapolis 22, Minn

MORE DATA? Circle 77, inside back cover

Electronic Tester Predicts Ball Bearing Performance

SmoothRotor is an electronic tester that predicts performance qualities of oil-lubricated precision ball bearings up to 1 in. OD by revealing vibrational characteristics.

On the production line, the tester screens bearings likely to cause rejection of completed components, separates damaged bearings from those which may be cleaned and reused, or locates operations responsible for dirt, contamination or damage to bearings.

The SmoothRator can be set up in 10 to 15 minutes and tests 60 to 100 bearings per hour. Price is $600 or $30 a month on lease.

The Barden Corp, 200 Park Ave, Danbury, Conn

MORE DATA? Circle 78, inside back cover

DEEP HOLE SPINDLE, 14 ft long, is a precision, heavy-duty boring mill ram equipped with a two-speed motor and interchangeable spindles. Excess capacity shaft and bearings permit heavy cuts, assure good finish ground holes, and long wheel life—*Pope Machinery Corp, Haverhill, Mass*

MORE DATA? Circle 79, inside back cover

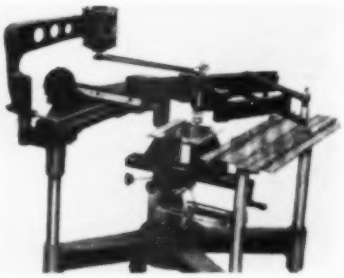


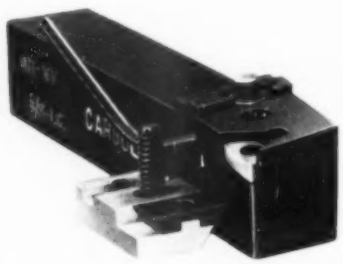
Table Model Engraver Can Be Used As Marking or Production Tool

Engravograph Model ITX can be used for engraving names and numbers, and for work requiring slotting, profiling, milling. Heavier construction features include a cast iron pantograph. Tracer guide enables unskilled labor to produce precision work from a master templet.

Unit cuts 1/16 in. deep in cold rolled steel in one pass, $\frac{1}{8}$ in. in non-ferrous metals; a 12 x 3½-in. area can be covered in one setup. There are 21 different ratio settings ranging from 2:1 to 7:1; settings can be changed in seconds without disassembly. Spindle has double depth regulator arrangement to guarantee uniform engraving depth, even on material of uneven surface.

New Hermes Engraving Machine Corp, 154 W 14th St, New York 11, NY

MORE DATA? Circle 80, inside back cover



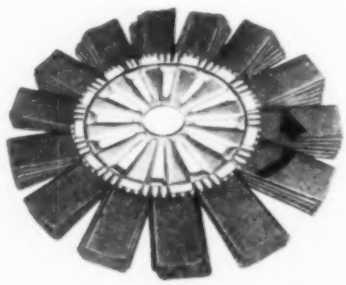
Carbide Insert Toolholder Has Indexing Adjustable Chip-Breaker

Carboloy Adjust-O-Breaker is designed to provide positive settings of the chip-breaker and infinite adjustment within its range through use of a locating pin mounted on a leadscrew in the holder shank running parallel with the cutting direction. Solid carbide double-edged chip-breaker is full floating, providing for uniform pressure distribution over its surface, thus preventing strain cracks and breakage of insert from line or point pressures. Cutting force is taken by the rail and major clamp screw. Chip-breaker is completely removable; both it and the clamp are held in proper alignment by keys and key slots.

Five styles, in both RH and LH models, are available in three different sizes, making a total of 30 negative rake toolholders in the line.

General Electric Co, Metallurgical Products Dept, 11177 E Eight Mile Rd, Detroit 32, Mich

MORE DATA? Circle 81, inside back cover



Grain-in-Depth Abrasive Wheels Said to Last 20 Times Longer

Uniflex and Amflex buffs, containing grain-in-depth instead of grit coating, are said to outlast ordinary cutting-polishing wheels by 20:1.

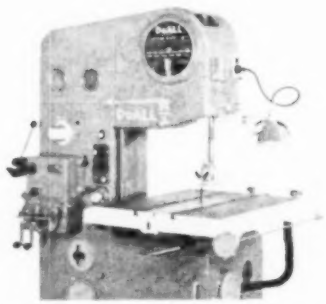
Uniflex wheel is made of flexible folded layers of abrasive impregnated fabric. This flexible construction allows the wheel to conform to all surfaces and reach down into crevices and grooves.

Amflex abrasive wheel is constructed in an extra loose pattern for air cooling at higher speeds.

Flex wheels are available in 16 sizes with 3, 5, 7, and 9 in. centers and in 80, 120, 240, and 320 grit.

American Buff Co, 2411 S LaSalle St, Chicago 16, Ill

MORE DATA? Circle 82, inside back cover

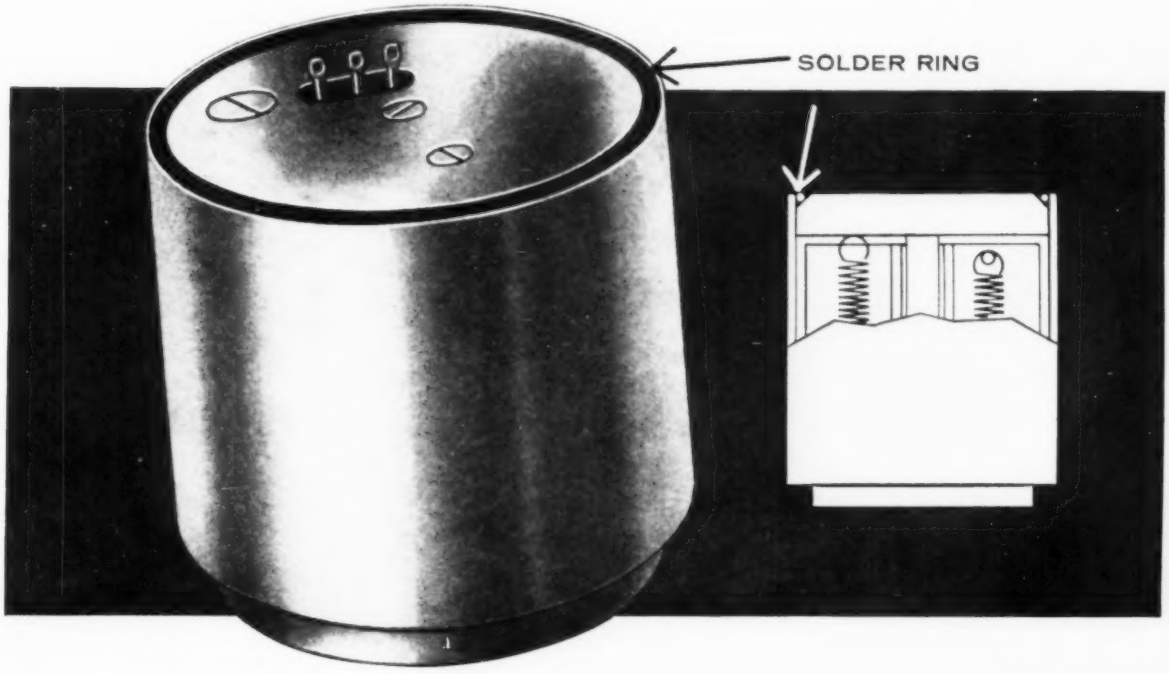


REDESIGNED CONTOUR-MATIC band machines, with 16 to 60 in throat depths, have power feed work tables and capacity to utilize Demon HSS saw bands—*DoAll Co, Des Plaines, Ill.*

MORE DATA? Circle 83, inside back cover

Precision soldering 7 Times Faster...

with TOCCO* *Induction Heating*



When G. M. Giannini and Co., Inc., Pasadena, California, switched from old-fashioned methods to TOCCO Induction Heating they increased production of these high-precision accelerometers from 4 to 30 per hour—with a commensurate *decrease* in production costs.

Here's what a Giannini official has to say about the TOCCO installation: "Prior to using TOCCO for this purpose, we had tried soldering irons, normal torches, resistance sealing, and even threaded screw fittings, with uniformly poor results. Essentially, the TOCCO unit has permitted us to build, in production quantities, oil-filled hermetically sealed units that could not be produced in any other way."

Whether your production bottleneck involves soldering, brazing, heat treating or heating for forming it pays you to investigate TOCCO as an economical way to do it better, faster and at lower cost.

THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today— NEW FREE Bulletin

The Ohio Crankshaft Co. • Dept. B-11, Cleveland 5, Ohio

Please send copy of "Typical Results of TOCCO Induction Brazing and Soldering".

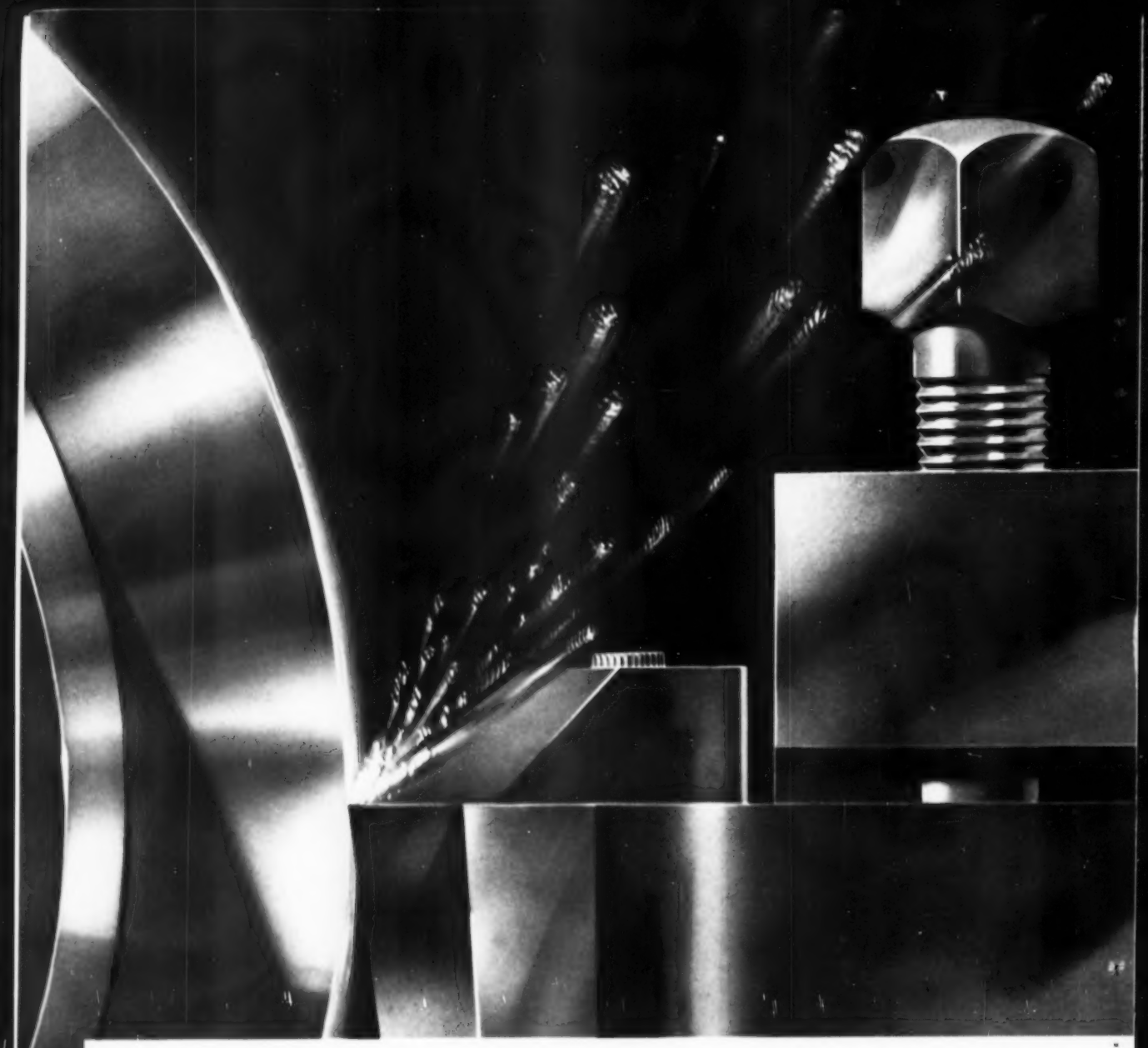
Name_____

Position_____

Company_____

Address_____

City_____ Zone____ State_____



Machinability is Malleable

It's the finished cost of machined components that's important to you. Remember then . . . Malleable iron is more machinable than any other ferrous metal of similar properties. With Malleable castings you'll reduce machining time as much as 50%, . . . increase tool life up to 250%, . . . get unexcelled surface finishes . . . and end your reject problems.

To find out how much you can cut your costs and improve your profits, contact one of the progressive firms that displays this symbol—

If you wish, you may inquire direct to the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio, for information.

MEMBER

MALLEABLE

CASTINGS COUNCIL

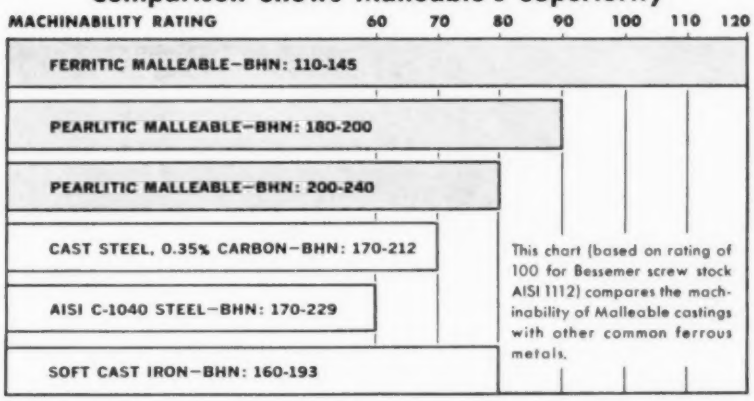
Machining Malleable Castings—Important Key to Cost Reduction

Malleable castings—the most machinable of all ferrous metals—cut quality components costs

Production men know that machining time, power consumption and rejects drop with the use of Malleable iron castings, while tool life and profits shoot up. The reason is simple: Malleable iron is the most machinable of all ferrous metals of similar properties.

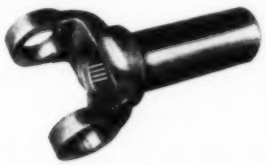
The following important factors work together to give Malleable such machining superiority: Malleable's microstructure contains tiny, evenly distributed nodules of carbon that help cutting tools quickly break the removed metal into small (Class A) chips; the carbon also acts as a lubricant, prolonging tool life; uniformity of properties throughout every casting permits running at optimum machining conditions.

Comparison Shows Malleable's Superiority



Typical Example Shows Savings of 70% to 250%

The conversion of automotive universal joint yokes from steel forgings to pearlitic Malleable castings typifies the savings provided by Malleable castings. Costs for the rough pieces and performance characteristics of the two materials are comparable. However, the castings are much more economical to machine. Considering that machining often costs two to four times as much as the rough parts, the economy resulting from using Malleable castings is substantial.



Conversion of this universal joint yoke to a Malleable casting increased production, lowered direct and tool room labor, and cut tool replacement.

One volume user of Malleable joint yokes reports the following savings after changing from steel to Malleable castings: 70% longer tool life in broaching the splines; 250% more pieces cut by the nut seat cutters; 149% more pieces in turning and facing the hub; an increase of 100% in production between wheel dressings in grinding the hub; 246% greater production in drilling the cross holes.

In each of these operations, the change to Malleable castings cuts direct production time by reducing the frequency of tool changes. Tool room labor and tool replacement are both reduced to fractions of their previous costs.

Throughout the metalworking industry, part after part is now being initially designed of Malleable or converted from other materials to take advantage of Malleable's unrivalled machinability . . . to produce better parts at lower costs.

New Information Now Available on Machining Malleable

Data Unit 106—Machinability of Malleable Castings—can be obtained from any member of the Malleable Castings Council, or from the Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.

These companies are members of the

MALLEABLE CASTINGS COUNCIL

CONNECTICUT
Connecticut Mall. Castings Co., New Haven 6
Eastern Malleable Iron Co., Naugatuck
New Haven Malleable Iron Co., New Haven 4

DELAWARE
Eastern Malleable Iron Co., Wilmington 99

ILLINOIS
Central Fdry. Div., Gen. Motors, Danville
Chicago Malleable Castings Co., Chicago 43
Moline Malleable Iron Co., St. Charles
National Mall. and Steel Castings Co., Cicero 50
Peoria Malleable Castings Co., Peoria 1
Wagner Castings Company, Decatur

INDIANA
Link-Belt Company, Indianapolis 6
Muncie Malleable Foundry Co., Muncie
National Mall. & Steel Castings Co., Indianapolis 22
Terre Haute Mall. & Mfg. Corp., Terre Haute

MASSACHUSETTS
Belcher Malleable Iron Co., Easton

MICHIGAN
Albion Malleable Iron Co., Albion
Auto Specialties Mfg. Co., Saint Joseph
Cadillac Malleable Iron Co., Cadillac
Central Fdry. Div., Gen. Motors, Saginaw

MINNESOTA
Northern Malleable Iron Co., St. Paul 6

NEW HAMPSHIRE
Laconia Malleable Iron Co., Laconia

NEW JERSEY
Meeker Foundry Company, Newark 4

NEW YORK
Acme Steel & Mall. Iron Works, Buffalo 7
Frazer & Jones Company Division Eastern Malleable Iron Co., Solvay
Oriskany Malleable Iron Co., Inc., Oriskany
Westmoreland Mall. Iron Co., Westmoreland

OHIO
American Malleable Castings Co., Marion
Canton Malleable Iron Co., Canton 5
Central Fdry. Div., Gen. Motors, Defiance
Dayton Mall. Iron Co., Ironton Div., Ironton
Dayton Mall. Iron Co., Ohio Mall. Div., Columbus 16
Maumee Malleable Castings Co., Toledo 5
National Mall. and Steel Castings Co., Cleveland 6

PENNSYLVANIA
Buck Iron Company, Inc., Philadelphia 22
Erie Malleable Iron Co., Erie
Lancaster Malleable Castings Co., Lancaster
Lehigh Foundries Company, Easton
Meadville Malleable Iron Co., Meadville
Pennsylvania Malleable Iron Corp., Lancaster

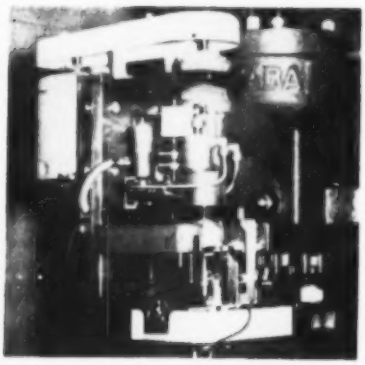
TEXAS
Texas Foundries, Inc., Lufkin

WEST VIRGINIA
West Virginia Mall. Iron Co., Point Pleasant

WISCONSIN
Belle City Malleable Iron Co., Racine
Chain Belt Company, Milwaukee 1
Federal Malleable Company Inc., West Allis 14
Kirsh Foundry Inc., Beaver Dam
Lakeside Malleable Castings Co., Racine
Milwaukee Malleable & Grey Iron Works, Milwaukee 46

◄ CIRCLE 275 READER SERVICE CARD

CIRCLE 276 READER SERVICE CARD



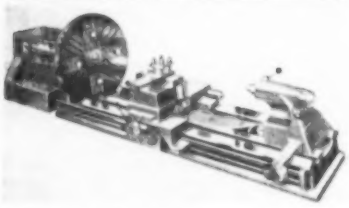
High-Speed Tapping Attachment For Punch and Multi-Slide Presses

Self-powered unit that can tap more than 6000 holes per hr, depending on size and depth of hole, can be mounted for either vertical or horizontal operation. Stroke of ram or cam of press actuates tap movement into hole; interlocks stop the press if tap fails to clear the hole.

Tap range is up to 5/16 in. dia. Average speed is 1750 rpm, withdrawal is 3500 rpm. Reversal at end of stroke and resetting to forward rotation is instantaneous. Attachment can be used in conjunction with other automated machines or it can be used separately for subsequent tapping operations. Standard stock units are available for multi-slide presses. Dies for punch presses in most cases have to be redesigned to incorporate tapping unit.

Smith Mfg Co, 208 St Clair Ave, NW, Cleveland 13, Ohio

MORE DATA? Circle 84, inside back cover



Italian Lathes Feature Twin Beds, 94½-in. Swing

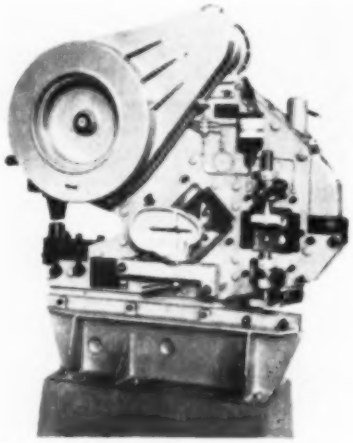
Two Italian-made lathes are designed for turning light large diameter workpieces such as missile components, heat exchanger components, tubes, cylinders, and cones. Each lathe has two separate beds, independent of the headstock. Swing is 94½ in. over carriage and bed.

The widest (58 in.) bed carries the hydraulically operated apron, compound and cross-slide. The second bed (42½ in.) bears the tailstock and rests.

Headstock unit houses the 28 hp ac drive motor which provides 18 spindle speeds from 0.6 to 160 rpm or an optional range of 1 to 275 rpm. Six of the speeds are through an internal gear face plate drive to handle both rough and finishing cuts on both small and large diameter work. The 6¼ in. dia spindle is mounted on three bearings.

Imported by Aaron Machinery Co, Inc, 45 Crosby St, NY 12, NY

MORE DATA? Circle 85, inside back cover



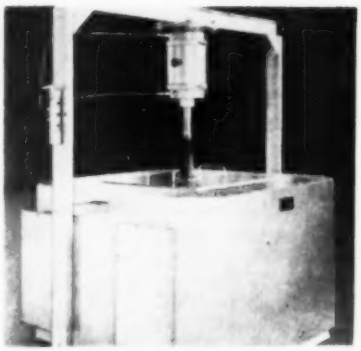
Universal Iron Workers Have Up to 1-in. Shearing Capacity

Sacma (made in Italy) Iron Workers for five operations are available in five sizes from ⅜ to 1-in. shearing capacity.

Frames are heavy rolled steel plate electrically welded into one solid unit. All shafts and working parts are chrome nickel alloy steel. Models incorporate centralized one-shot lubrication. Knives for angles and T's are separate from knives for round and square bars and are mounted on independent slides. Knives for I-beams and U-channels and Z-sections are easily exchanged. Shearing blades and knives for round and square are reversible and can be used in 8 different positions. Angle and T cutter knives, vertical bar cutter, shear and notcher follow a straight motion line giving better direction of cut and longer tool life.

Distributed by Hermes Machine Tool Co, 48-15 Northern Blvd, Long Island City 1, NY

MORE DATA? Circle 86, inside back cover



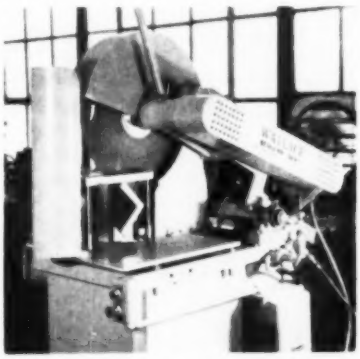
Electric Furnace Designed For Hot Load Testing

Unit is capable of pressure sintering at elevated temperatures up to 2750 F at pressure on the heated load up to a max of 200 psi.

Infinite control of the pressure exerted on the heated load is provided by a manual control lever operating a hydraulic cylinder and ram mounted on the pressure frame. Temperature can also be very closely controlled. Power controls and purchaser's choice of temperature controls are mounted on a separate panel. Power controls consist of voltage regulating transformer, fine to coarse deadfront switches (36 taps), direct reading input ammeter, and a magnetic contactor. Power requirements are 23 kw, 220/60/3 (440/3 also available). Chamber size is 15 x 15 x 18 in. deep. Over-all size is 36 in. deep, 46 in. wide, 60 in. high.

Pereny Equipment Co, Chambers & Perco Sts, Columbus 12, Ohio

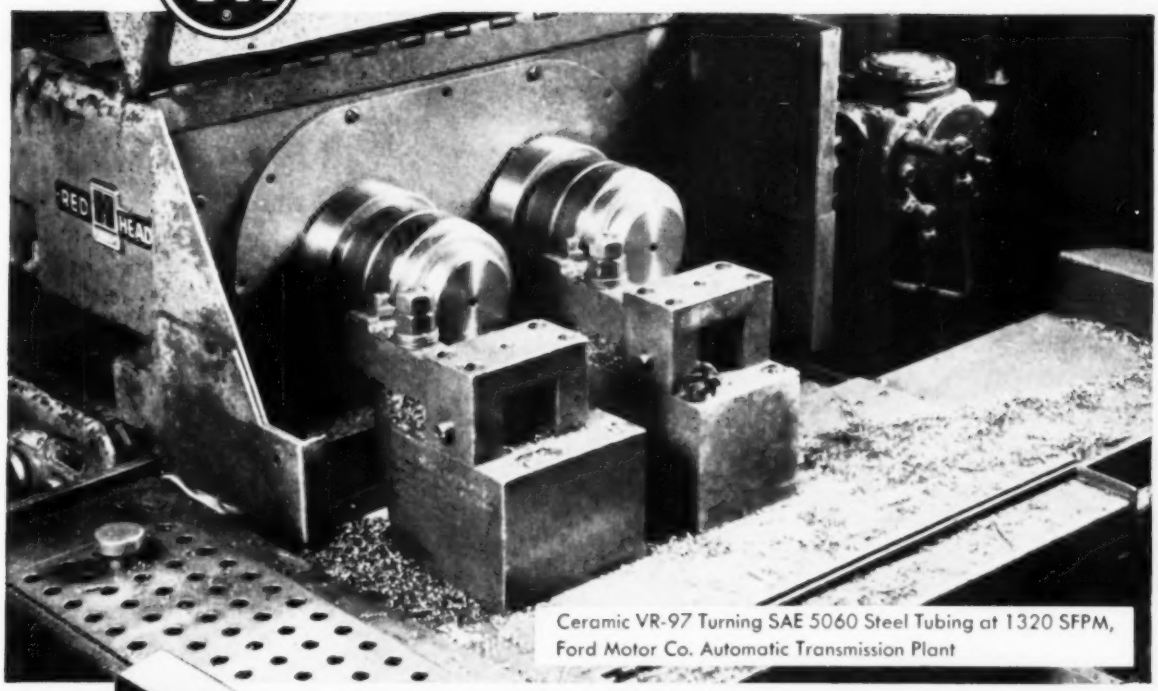
MORE DATA? Circle 87, inside back cover



MODULAR CUT-MACHINING UNITS cut up to 8 x 8 x 69-lb wide flange beam, 8-in. extra heavy pipe, 5-in. round or 4-in. square solid bars. Machines are available with 16, 18, 20 and 26-in. dia cutoff wheels—*Wallace Supplies Mfg Co, 1304 Diversey Parkway, Chicago 14, Ill*

MORE DATA? Circle 88, inside back cover

Ceramic VR-97



Ceramic VR-97 Turning SAE 5060 Steel Tubing at 1320 SFPM, Ford Motor Co. Automatic Transmission Plant

Proven in production at Ford Motor Company

Ceramic VR-97 is a proven performer in many machining operations at the Ford Motor Company's Automatic Transmission Plant, Livonia, Michigan. Here, and in hundreds of other progressive plants across the nation, VR-97 has been proving its value on continuous production runs. People who considered ceramic tooling as merely "experimental" a short time ago now rely on ceramic VR-97 as an important part of their production picture.

Whether you are interested in increased machine output, higher speeds, better finish or machining hardened steel and cast iron, it will pay you to know more about ceramic VR-97. Contact your nearest V-R representative or write for complete information.

Ask for Product Information BULLETIN NO. 59.1 covering Ceramic VR-97.

Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

C-729

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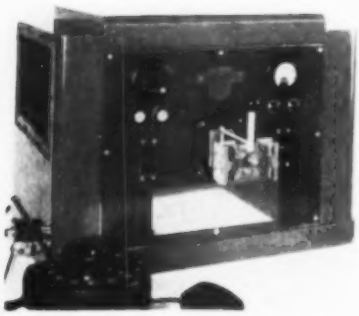
CIRCLE 277 READER SERVICE CARD



Induction Heating Offers Coil Sets, Bench Type Generator

Ther-Monic induction heating generator is a bench type unit used for hardening, brazing, soldering, forging and annealing.

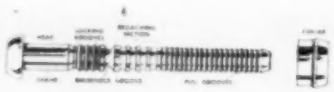
Model 150 has power input of 220-v ac, single phase, 21-amps, 460-va with a 90% power factor. Output is 114 Btu per minute, 2-kw at 450-kc.

Accessories include a two-position transfer switch, foot switch, automatic timer, and variable output control. Using the two-position switch, the operator can prepare one part while the other is being heated.

Master coil set complete with inserts is said to require minimum storage space and have low coil voltage. Coils and inserts come in two and four-inch ID sizes. Two-inch size inserts have openings from $^1/_4$ to $1^3/_8$ in. ID in $^1/_8$ in. steps. Four-inch size inserts have openings from $1^5/_8$ to $3^1/_8$ in. in $^1/_8$ in. steps. Thicknesses are $^1/_8$, $^1/_4$ and $^1/_2$ in.

Induction Heating Corp, 131 Wythe Ave, Brooklyn 11, NY

MORE DATA? Circle 89, inside back cover



Huckbolt Offers Self-Broaching And Self-Sizing Fastener Line

New line of self-broaching and self-sizing Huckbolt fasteners automatically produces optimum interference-fit installation. Interference-fit is said to provide leakproof joints and improved structural rigidity.

Both the self-broaching and self-sizing designs have the same shear and tension values as close-tolerance Huckbolt fasteners of equal diameter in AISI 4037 material. The same collars are used with new pin designs, recommended for joining aluminum alloy components.

The new fasteners are installed by "double-driving" using standard installation tools. The pin is pulled through the hole into an interference fit; the collar is applied and swaged into locking grooves on the pin; the tail end of the pin, containing pulling grooves for the tool to grip, is broken off and discarded.

Huck Mfg Co, 2480 Bellevue Ave, Detroit 7, Mich

MORE DATA? Circle 90, inside back cover

Splined Milling Arbors Speed Machining of High-Strength Alloys

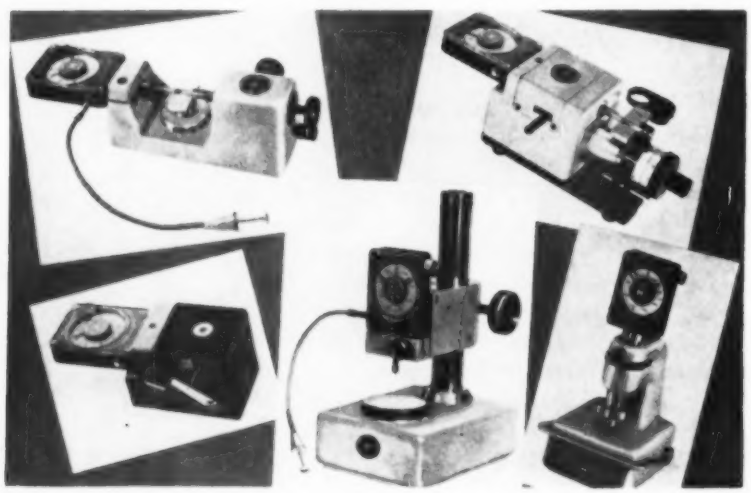
These splined milling arbors and cutters are designed for heavy-duty performance, particularly in the machining of high-strength alloys in the hardened state. Metal removal rates are reported increased by 92% to 400% with cutter life increased proportionately.

Both arbors and spacers used with them are splined. Resistance to torsional deflection of the assembly is said to be much greater than that of a plain arbor of the same size. Reduced backlash makes very fast cutting possible and the chatter that causes carbide tips to shatter is virtually eliminated. Milling cutters, precisely positioned on the accurately ground ID of the splines, are driven by the sides of all six splines, not by a single soft metal key as is the case with plain arbors and cutters. As a result, the take-up nut need only be brought up to hand-tight with a wrench. This, and the fact that the faces of the spacers are precision ground flat and parallel, is said to minimize distortion.

Line includes arbors, cutters, spacers, and flywheels. Both the splined cutters and arbors can be used interchangeably with conventional plain types of the same size. Arbors, with 50 mm taper, are made in 1, $1^1/_4$, $1^1/_2$, and 2 in. diameters in standard lengths.

Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn

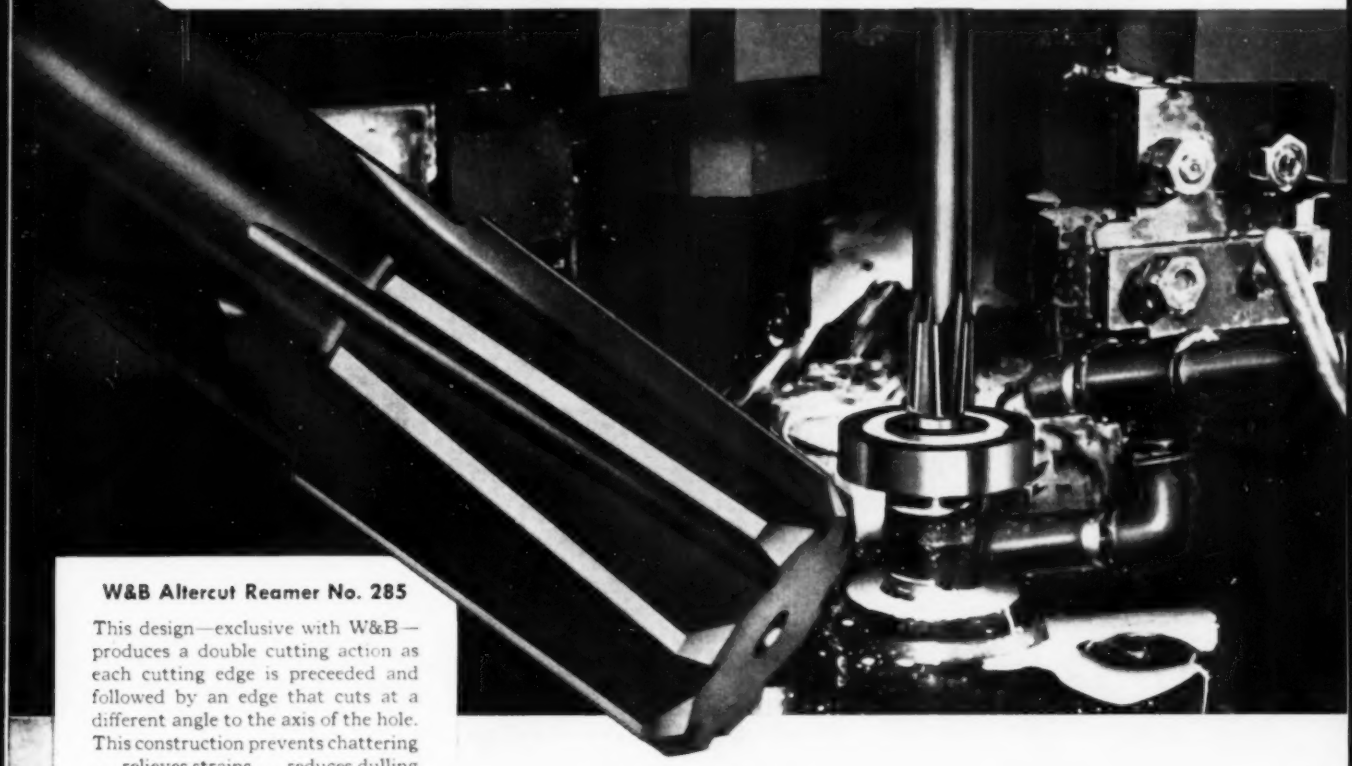
MORE DATA? Circle 91, inside back cover



FIVE NEW GAGES, specially designed for miniature work, have been added to Kwik-Chek line. Clockwise, from top left: horizontal jaw gage; horizontal indicating micrometer gage; recess depth gage; precision dial comparator; small bore gage. Accuracy is within 0.00005 in. Jeweled Micro-Dial indicator on each model has both zero and tolerance-pointer adjustments; metric dials available on special order—*Hamilton Watch Co, Industrial Div, Lancaster, Penna*

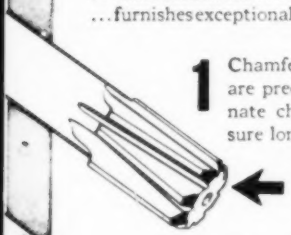
MORE DATA? Circle 92, inside back cover

Long range economy PLUS finer finishes
WHITMAN & BARNES REAMERS

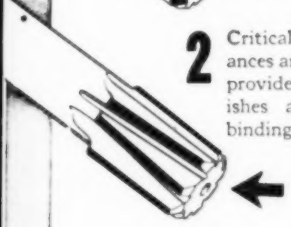


W&B Altercut Reamer No. 285

This design—exclusive with W&B—produces a double cutting action as each cutting edge is preceeded and followed by an edge that cuts at a different angle to the axis of the hole. This construction prevents chattering . . . relieves strains . . . reduces dulling . . . furnishes exceptionally fine finishes.



1 Chamfer relief angles are precise . . . eliminate chatter and assure longer life.



2 Critical land clearances are accurate . . . provide smoother finishes and eliminate binding.

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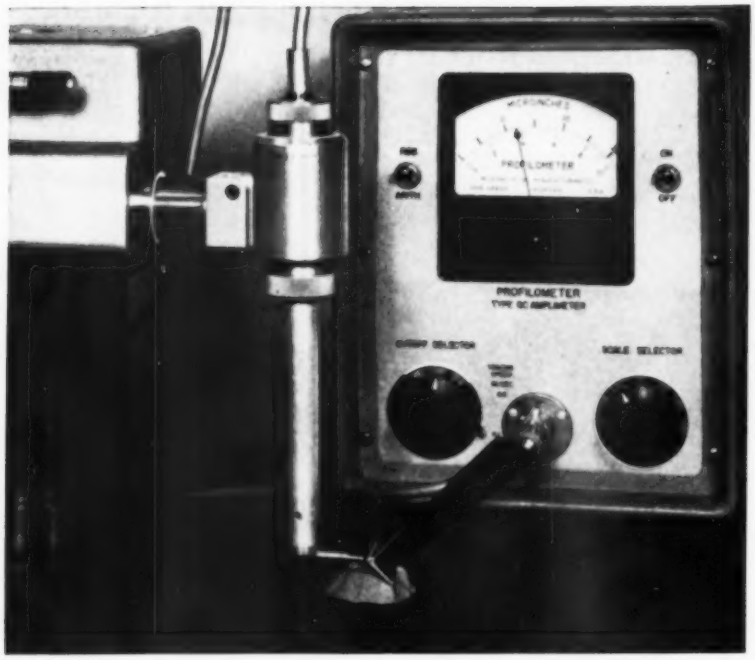
NEW YORK CHICAGO LOS ANGELES



PERTINENT QUESTION:

WHY do you need the Profilometer®?

FACTUAL ANSWER:

To check practically *all* surfaces against microinch roughness specs —and to help cut production costs in 7 different ways.

FREE BULLETIN LT14 gives details on the Profilometer and its practical applications. May we send you a copy?

MICROMETRICAL MMC MANUFACTURING COMPANY
345 S. MAIN ST. ANN ARBOR 1, MICHIGAN

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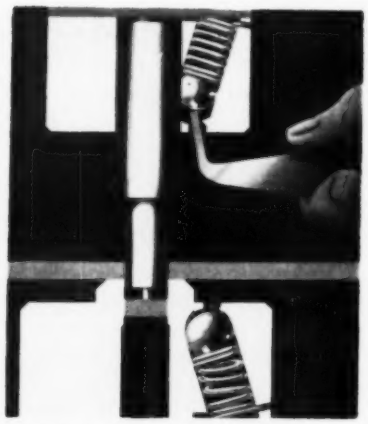


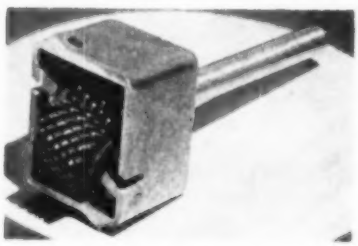
Slug-Shedder Punch Eliminates Slug Pulling in Any Die

Unit reportedly eliminates slug-pulling in any die regardless of material being pierced or thickness of it. Punches have a body of HSS that contains a coil spring. End of this spring extends 3/64 in. beyond the punch point. When piercing materials, the compressed spring immediately pushes each slug away from the punch point.

Standard units are available with round points in diameters from 1/16 to 5/8 in. and punch lengths from 2 to 3 in. Specials can be furnished in any size or shape. Standard shank diameters and the R-B ball lock make these units completely interchangeable.

Allied Products Corp., Richard Brothers Punch Div., 26500 Capitol Ave., Detroit 39, Mich

MORE DATA? Circle 93, inside back cover

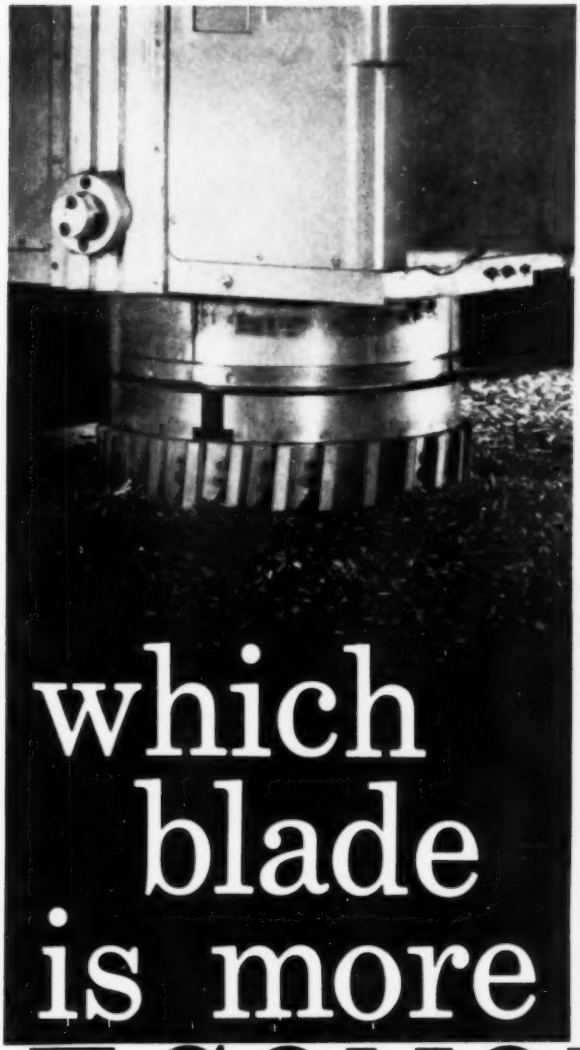


Grinding Wheel Dresser Offered for Heavy-Duty Jobs

Model 10 is 6 in. long with a 3/4-in.-dia shank, is constructed of high tensile strength cast aluminum alloy. Arbor equipment has sealed ball bearings.

Specially developed cutters and abrasive wheels are interchangeable. Built-in tangential angle of the cutters (or wheels) eliminates need for a breaking device and assures sharp,

high speed steel or carbide...



which blade is more ECONOMICAL?

Even in the most ordinary milling and boring work, fields of application have a habit of overlapping. And, as a result, choice of the most economical and efficient blade material can often be a challenging problem.

Solutions to machining problems like these are our primary product. You don't buy Ingersoll cutters, as such—or high speed steel or carbide blades. What you buy is lower operating costs and improved finish. You buy increased productivity!

Only after a thorough study of your machine, work piece, depth of cut, speed, feed rates and finish requirements do we recommend any cutter. And we assume full responsibility for every recommendation we make.

We would welcome the opportunity to tell you more about this unique cutter selection service. Write:

INGERSOLL CUTTER DIVISION — REDUCE THE COST OF CHIPS

This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No. 68 K.

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Consider Service—Bijur Field Engineers work hand in hand with machine builders to custom design a Bijur system which will amply meet the needs of the machine for automatic lubrication.

How you benefit—Whether you are a designer, purchasing agent, or plant engineer, you'll see substantial savings when you have Bijur Systems in the equipment you own and manufacture. Custom designed, Bijur Systems are easy to install, reduce down-time and repair bills, increase production, eliminate costly hand oiling. There's no chance for product spoilage due to over-lubrication, Bijur Systems deliver the right amount of metered oil to every bearing, *when it's needed.* Costly hand oiling is eliminated.

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BIJUR

LUBRICATING CORPORATION

Rochelle Park, New Jersey

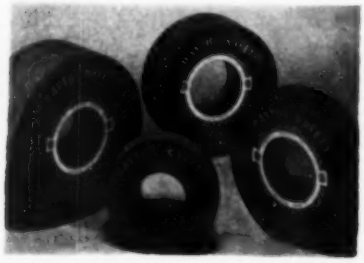
Pioneers in Automatic Lubrication

4505

cool grinding while minimizing burn checks and flying dead grain. Model will fit standard Peterson cylinder head and Lempco grinders.

L Newman, 1001 25th St, Oakland 7, Calif

MORE DATA? Circle 94, inside back cover



Rubber Bonded Regulating Wheels For Centerless Grinding Jobs

Dayton Safety centerless regulating wheels are designed for use in all types of centerless grinding operations. Special manufacturing processes reportedly produce uniformly balanced wheels with accurate dimensions, permitting precision grinding to closer tolerances with smoother finishes and no chatter marks.

Units are made of aluminum oxide and utilize a rubber bonding agent. Type 1, 5, and 7 wheels are available in sizes from 8 to 14-in. diameters.

Simonds Worden White Co, 1101 Negley Pl, Dayton 7, Ohio

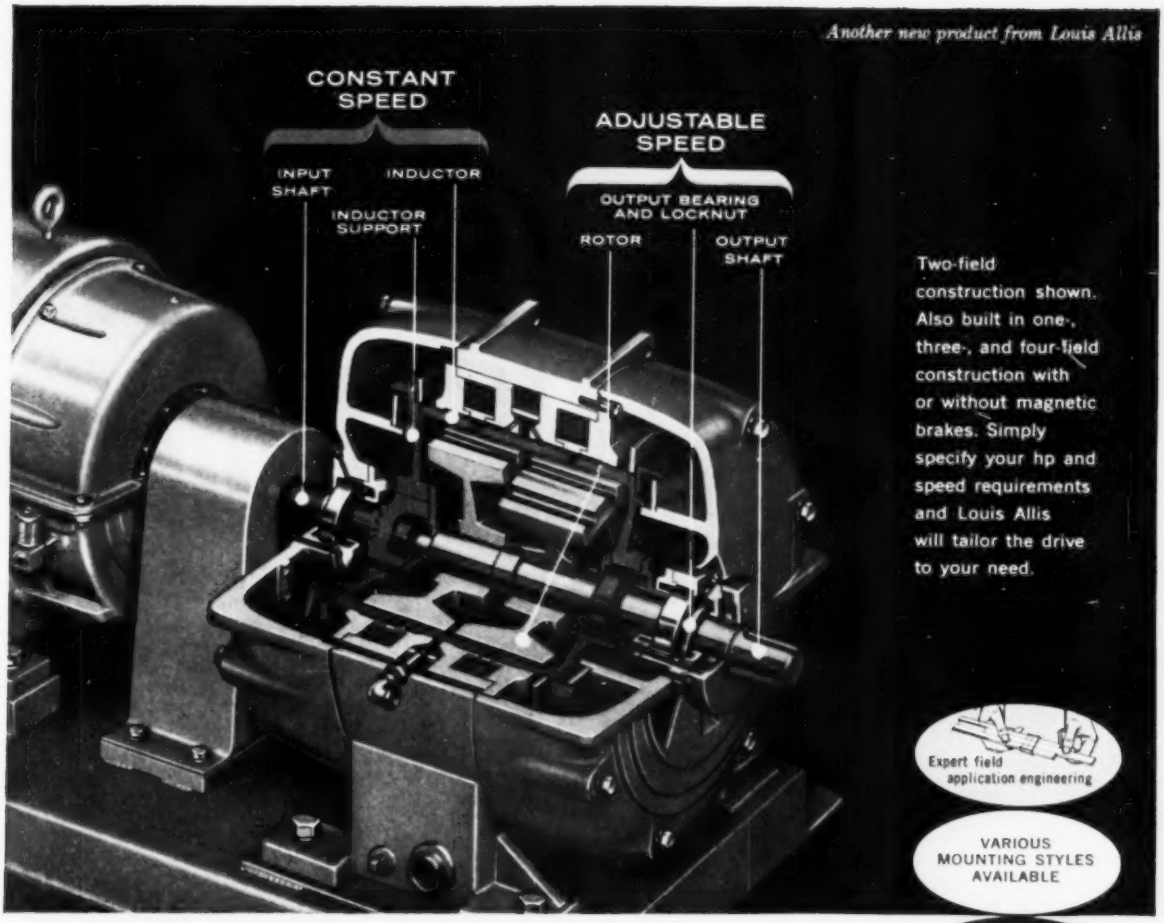
MORE DATA? Circle 95, inside back cover

Thread Measuring Wire Carriers Offered in Two Types

Carriers for the 3-wire method of thread measurement are said to make the process as easy as making plain OD measurements. Free floating action of the wires within adequate limits gives proper seating for correct readings.

Attachments are of two main kinds—those for micrometers and those for measuring machines having 3/8-in.-dia anvils. Micrometer carriers are made especially for Starrett micrometers (0.234 spindle and anvil dia, anvil height 0.070 min) and will measure the PD of Americal National and Unified 60° treads from No. 0

Another new product from Louis Allis


CONSTANT SPEED
ADJUSTABLE SPEED
INPUT SHAFT
INDUCTOR
INDUCTOR SUPPORT
OUTPUT BEARING AND LOCKNUT
ROTOR
OUTPUT SHAFT
Two-field construction shown. Also built in one-, three-, and four-field construction with or without magnetic brakes. Simply specify your hp and speed requirements and Louis Allis will tailor the drive to your need.
Expert field application engineering
VARIOUS MOUNTING STYLES AVAILABLE

The new Louis Allis MAGNETIC DRIVE

A compact, adjustable speed drive up to 2000 hp!

Based on a liquid-cooled magnetic coupling design, the *all-new* Louis Allis Magnetic Drive offers you the finest in precise regulation, compactness, and design flexibility for adjustable speed drives up to 2000 hp.

A unique annular cooling manifold provides effective heat transfer. It eliminates "water-drag" since there is *no* liquid in the air gap between the constant-speed and adjustable-speed members. There's no "flooding" the Magnetic Drive or forcing of water into bearings. And you'll *never* find condensation in the bearings. The reason: a planned flow of air through the drive reduces bearing temperatures and exhausts any condensation which might occur as the unit cools off after use.

Stationary field construction eliminates slip rings. All bearings can be lubricated without disassembly, and grease chambers provide ample grease reservoirs. Coils and lead connections are encapsulated in a chemical- and heat-resistant polyester — and simplified construction eases inspection and servicing. The *all-new* design permits simple relocation of cooling inlet, conduit box, discharge, etc., regardless of direction of rotation.

If your plans call for adjustable speed drives — specify Louis Allis Adjustable Speed Magnetic Drive. Write for a copy of Bulletin 3650 — now available at your Louis Allis District Office, or from The Louis Allis Co., 452 E. Stewart Street, Milwaukee 1, Wisconsin.

LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE SPEED DRIVES

ABD-135

Today, tomorrow . . . for

THIS is full of ideas faster payback...

If ever there were a master mind in machine tools, it's Frauenthal's Single Spindle Vertical Precision Grinders!

These heads are crammed with special talents . . . busy ideas that up production on *more* of today's jobs. And Frauenthal builds in flexibility that anticipates tomorrow's work assignments for sustained profit life. All a result of look-ahead engineering that gives you *widest* possible working ranges and more *application potential* than any comparable size machine.

More Frauenthal 1200 Series advantages: choice of either belt-driven or direct-connected grinding spindle types—uncanny accuracy — super-precision to .0001" at the spindle nose. Extra rigidity with all-welded steel base construction. Unique positioning versatility — for angular, internal, outside diameter and face grinding. Tracer control or numerical control available for contour grinding. Simplified design — with pushbutton controls for freedom in setup and operation. Write direct for 1200 Series Grinder details.

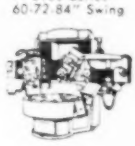
Above—Frauenthal direct-connected model (slide and spindle positioned for angle feed grinding). *At right*, Frauenthal belt-driven model. These grinders have an extreme angle setting of compound at 45° . . . spindle at 90° to slide. Machines with either spindle arrangements are offered with 24" dia. tables x 36" swing . . . 36" dia. tables x 48" swing . . . and 42" dia. tables x 54" swing.

F **PRECISION PRODUCTION VERSATILITY**

2200 Series 72-150" Swing

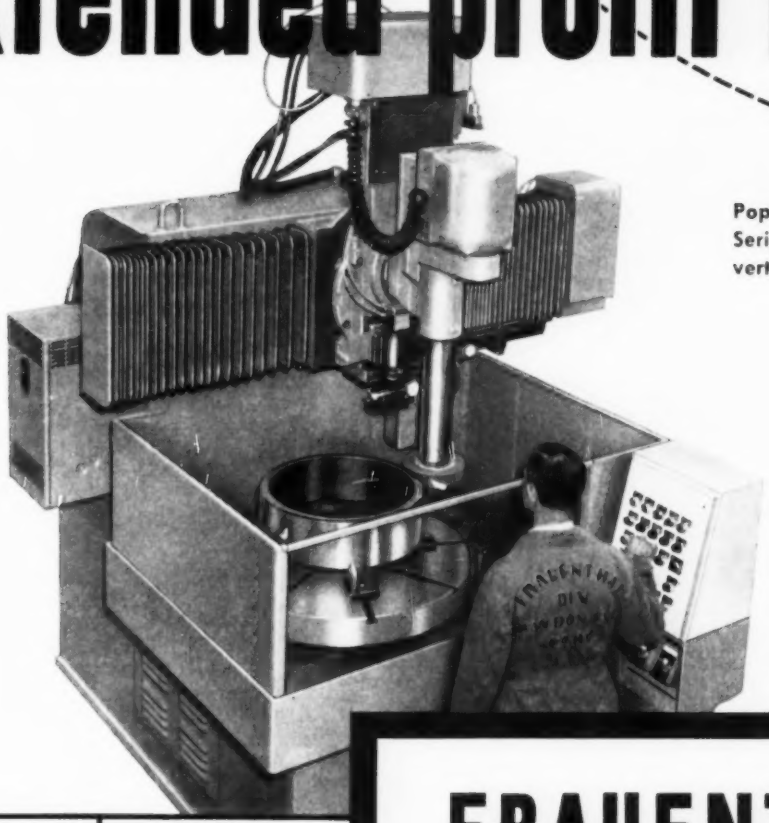
1800 Series 60-72-84" Swing

3100 Series 60-72-84" Swing



years to come . . .

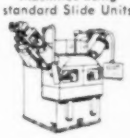
HEAD for extended profit life



Popular Frauenthal 1200 Series single-spindle vertical precision grinders

1200 Series 36-48" Swing

Special Grinding Machines using standard Slide Units



FRAUENTHAL

DIVISION

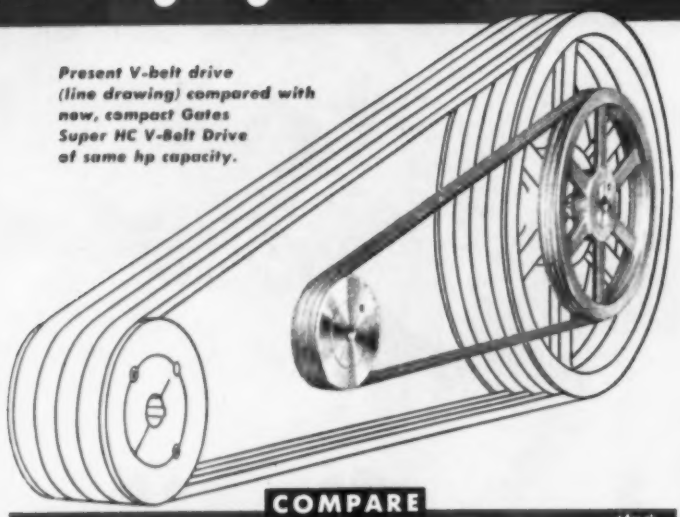
THE KAYDON ENGINEERING CORP.

Muskegon, Michigan, U. S. A.

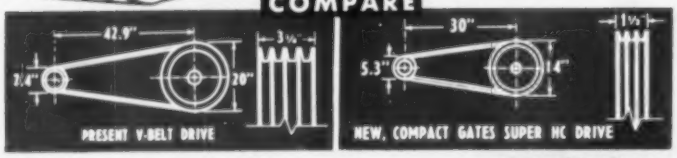
CIRCLE 284 READER SERVICE CARD

Designing NEW DRIVES?

Present V-belt drive (line drawing) compared with new, compact Gates Super HC V-Belt Drive of same hp capacity.



COMPARE



Save up to 20%

with new high capacity V-belt drive

When you change the whole drive — both V-belts and sheaves — remember: The cost of a Gates Super HC V-Belt Drive is as much as 20% less than the cost of present V-belt drives of the same horsepower capacity.

A development of Specialized Research in the world's largest V-belt laboratories at Gates, the new Super HC V-Belt makes possible the most compact, lightest-weight, lowest-cost multiple V-belt drive you can put on any machine!

Cuts drive space as much as 50%

With Gates new Super HC V-Belt, sheave diameters and widths can be reduced 30% to 50%, center distances 20% and more. Bearing load is lightened and total space occupied by the drive may be cut as much as 50%.

"The Modern Way to Design Multiple V-Belt Drives" is an informative handbook on the Super HC Drive, available from your nearby Gates Distributor listed in the Yellow Pages of your phone book.

The Gates Rubber Co., Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ont.
World's Largest Maker of V-Belts

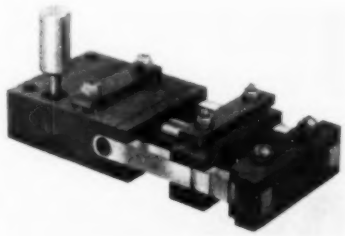
TPA 439

Gates SUPER HC V-BELT Drives

though 3/4 in. dia, all standard pitches 10 through 80 tpi. Sets are available containing the 19 pairs of carriers for the above range plus a micrometer and pair of measuring machine spindle adapters. Set is also available just for measuring machines and covers all standard threads, No. 0 through 1 in. and 8 through 80 pitch.

Standard Gage Co., Poughkeepsie, NY

MORE DATA? Circle 96, inside back cover



Punchpress Feeds Handle Stock 1½ in. Wide to 0.050 in. Thick

Two models of Rapid-Air feeds are designed to feed stock in thickness from 0.003 to 0.050 in. Units repeat within an accuracy of 0.0005 in. without use of pilots. They are air-operated and mount on the dieset or bolster. Both are 3 in. wide with max height of 3½ in.

Model A-2 with a stroke length of 0 to 2 in., max speed over 200 strokes per minute, has over-all length of 7½ in. Net weight is 5½ lbs. Model A-4 with stroke length 0 to 4 in., max speed over 150 spm, length 9½ in., weighs 7½ lbs. Units have a ⅛-in. NPT air connection; they will work on an air supply range 75 to 150 psi.

Mechanical Tool and Engineering Co. 2323 23rd Ave, Rockford, Ill

MORE DATA? Circle 97, inside back cover

Automatic Feed Recessing Tools Have Interchangeable Parts

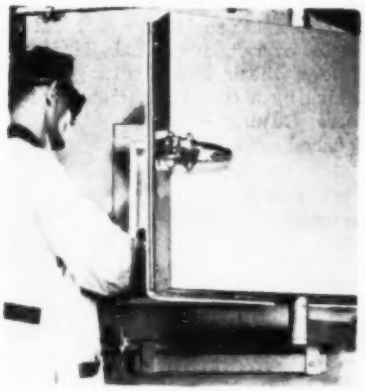
Designed for use on standard drill-presses, radial drills, and special machines, units eliminate need for complex special tooling in performing intricate machining operations such as relieving, grooving, chamfering,

backfacing, counterboring, necking, and boring. Two basic types and seven standard sizes cover work hole diameters from $^1/_4$ to $4^1/_2$ in. and up to 0.300 in. depth of cut. Four sizes of tools take interchangeable stop collars and pilot-nose assemblies for piloting either in fixture bushings or in the work. Three sizes are provided for piloting only in the work and come with standard pilot-nose blanks. Both types are available with either eccentric or concentric tool mounting.

Automatic and continuous feed, which begins when the stop collar contacts the work (for fixture bushing), is actuated by a simple lead cam mechanism in the tool body. Adjustable stop collars and quick-lock nuts with large graduations simplify and speed setting tools for location and depth, provide accuracy to 0.001 in.

Scully-Jones & Co. 1901 S Rockwell St. Chicago 8, Ill

MORE DATA? Circle 98, inside back cover



West Instrumentation Improves Huppert Furnace Performance

Huppert furnaces designed for automatic processing of metal, ceramic, and chemical products incorporate instruments using specially developed high temperature thermocouples. Known as the KR-Super, these additions to the KR line provide for continuous operation at temperatures up to 3100 F without requiring protective atmosphere, skilled operators, or manual transformer tap switching. Available in a wide range of sizes, they include multi-zone models.

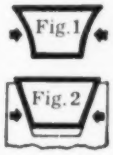
Molybdenum-disilicide electrical heating elements are modified with cermet-like material to avoid scaling, flaking, and instability or inefficiency at any temperature. West Gardsman Models JP electronic pro-

Need REPLACEMENT V-BELTS?

Improved Gates Vulco Rope gives you 2 important advantages

1. 40% higher hp rating at no increase in price: This important cost-saving advance is the result of Specialized Research in the world's largest belt-testing laboratories at Gates. **As replacements on standard drives these V-belts with 40% more load-carrying ability give longer service life...reduce down-time, cut belt replacement costs.**

2. Concave Sides (U. S. Pat. 1813698): The sides of Gates Belts are concave (Fig. 1). When the belt is bent around the sheave, the concave sides fill out—become straight—for full, uniform contact with the sides of the sheave groove (Fig. 2). Uniform contact insures maximum pulling power...even distribution of wear...longer life.



Available in all sizes from your nearby Gates V-Belt Distributor listed in the Yellow Pages of your phone book.

When designing new drives
use Gates new Super HC V-Belts and Sheaves.
See opposite page.

The Gates Rubber Co., Denver, Colorado
Gates Rubber of Canada Ltd., Brantford, Ont.

World's Largest Maker of V-Belts

Gates

TPA 432

Gates Hi-Power VULCO ROPE V-Belts

RIGIDITY + SPEED

for nonferrous face milling

a new achievement in design

All the advantages of high speed rotary table feed . . . with rigidity in overall construction *for machining accuracy* equal to that of the finest bed type machine.

a new dimension in speed

Equipped with the famous direct drive Onsrud high speed motorized milling head. Ample power and speed for all nonferrous milling. Precision built, dynamically balanced, air or liquid cooled for continuous high speed operation.

a new range in productivity

Unequalled productivity for any application from short "job shop" runs to large volume production. High speed table feed is infinitely variable for any type of work.

ONSRUD

MM-48 ROTARY FEED VERTICAL
MACH-MIL

Complete information . . . write for Bulletin 1176

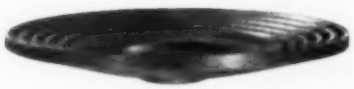
ONSRUD MACHINE WORKS, INC.
7712 LEHIGH AVENUE • NILES 48, ILLINOIS
(Suburb of Chicago)

Telephone: Niles 7-8700 • Cable Address: Onsrudmach

portioning controller and JL high-limit safety instrument, both with thermocouple break protection, assure unusual accuracy with safety at these high temperatures. Using the panel, operator sets the run-up cycle and control for the job to be done.

West Instrument Corp, 4363 W Montrose Ave, Chicago, Ill

MORE DATA? Circle 99, inside back cover

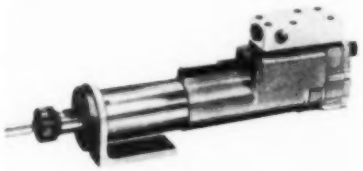


Dished-Depressed Center Wheel Offers Higher Cutting Speeds

Three layers of fiberglass reinforce this dished-depressed center grinding wheel, providing a 2:1 safety ratio over conventional depressed center wheels. Faster cutting is provided by a constant narrow contact area. Cutting is said to be accomplished without loss of grinder power or speed, resulting in faster cutting and higher efficiency. Wheel is said to retain its original thickness throughout cutting life. The narrow-face contact area reduces excessive heat build-up, resulting in a cool cutting action and minimizing possibility of heat cracks and breakage.

American Emery Wheel Works, Red Bridge, Providence, RI

MORE DATA? Circle 100, inside back cover

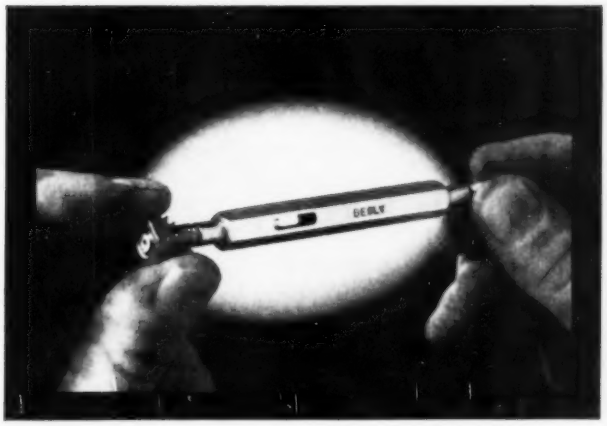


Tapping Unit Said to Eliminate Thread Stripping, Tap Breakage

Tru-Thread Tapper has controlled-pitch lead screw feed, with lead screw pitch the same as the tap, to eliminate thread stripping or tearing and tap breakage.

Designed for either portable or stationary operation, Models 93B-00 and 93B-5, handle hole sizes from

New Besly CP-75 precision gages last 3-5 times longer



Now you can have Besly Precision Gages in *extra hard* chrome plate. Made to tolerances according to U. S. Bureau of Standards specifications, Besly CP-75 precision gages last from three to five times longer than ordinary steel gages. They give you more piece parts per gage, less downtime for gage inspections, lower gage inventory, and will not chip or peel. See your distributor, or *write us today for catalog giving complete information on our full line and prompt service.*

BESLY®

BESLY-WELLES CORPORATION

120 Dearborn Ave. South Beloit, Illinois

Grinders and Abrasives • Taps • X-Press Taps® • Drills • Reamers • End Mills • Tool Bits
Gages • Carbide Tipped Tools, Blanks, Lapped Toss-away Inserts and Holders

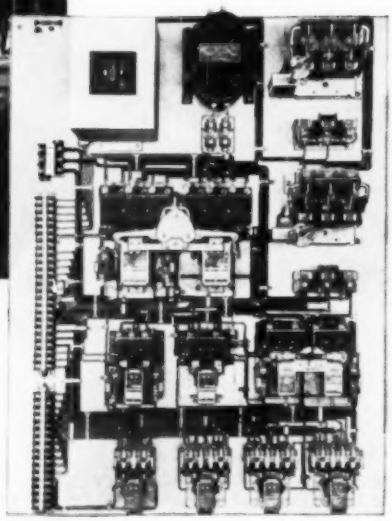
SQUARE D PRESS CONTROL

Built the Way You Want It!

Square D control is used by virtually every stamping press manufacturer in the country—and is approved by the three largest automobile manufacturers.

What's behind this preference for Square D? Biggest reason, we believe, is *completeness* of line which enables us to *custom build* to individual requirements, using *standard* control components. Actually, that has a bearing on a lot of things—including delivery, safety, uninterrupted production, maintenance parts standardization, plus field engineering service.

On the next press you buy, specify SQUARE D CONTROL.



above • **typical Square D press control panel, designed and built to customer specifications, using standard components**

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

No. 2 to 1 in. diameter with variety of speeds. Stroke is adjustable from maximum of 1½ in. for the 93B-00 and 3 in. for the 93B-5, to a minimum of 3/16 in. for both. Depth adjustment repeats within 0.005 in.

With hard or difficult materials, the operator can jog the tap by manipulating the forward and return poppets. Tappers can be actuated by remote poppets for automated applications. A pressure signal at the end of the operating cycle can be used to actuate indexing and other operations.

Gardner-Denver Co. Quincy, Ill

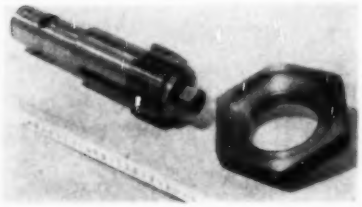
MORE DATA? Circle 101, inside back cover

Orbital Air Sander Operates at 8500 rpm

High-speed tool for finishing of metal, wood, plastics, and other materials is powered by the Aro air motor, operates on normal airline pressure. Tool sands up to the edges, making extra finishing operations unnecessary. Snap-on snap-close abrasive holder takes standard 3-2/3 x 9-in. abrasive sheet.

Aro Equipment Corp. Bryan, Ohio

MORE DATA? Circle 102, inside back cover



Tap Said to Produce Large Diameter Parts at Low Cost

Tap, made up of a master driving shank and a hardened steel shell, is said to produce large diameter nuts and special tapped parts at low cost. The shank can be supplied with a variety of tapping members for diameters up to six inches.

The tap is also reported to increase accuracy and uniformity and permit close size control in large diameter threading. It has been used to tap a 4¼-in. dia part out of thin

GOSS and DE LEEUW
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method . . . exclusive with Goss & De Leeuw . . . provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

CIRCLE 290 READER SERVICE CARD

DOW | METAL PRODUCTS

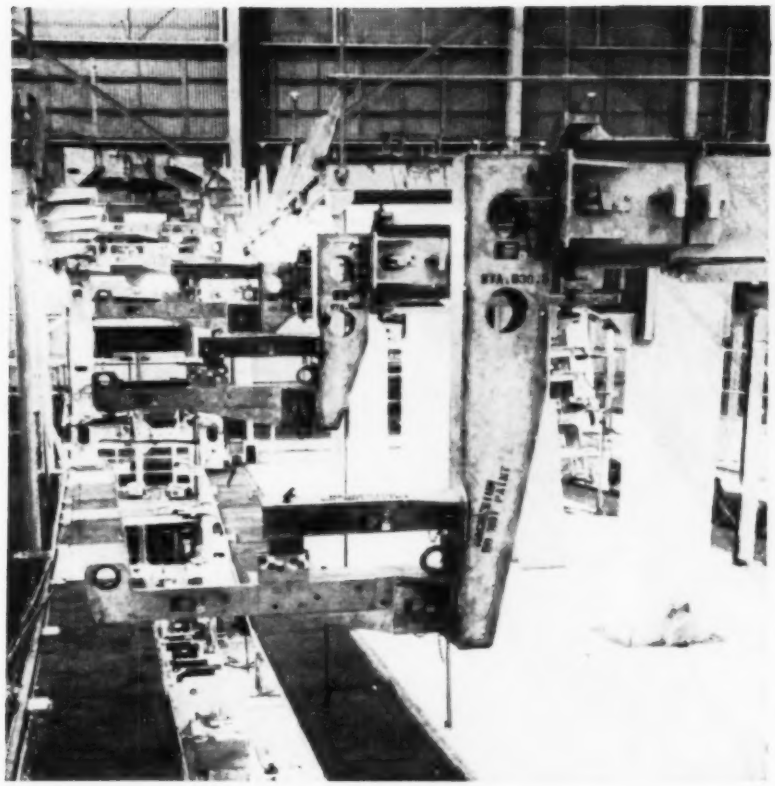
NEW BOEING 707 is first JET to fly in commercial service in the U. S. Extensive use is made of magnesium tooling plate in building the 707.

LIGHTER, FLATTER MAGNESIUM TOOLING PLATE

helps build new jet airliner

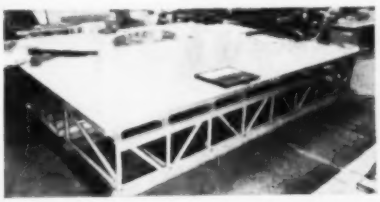
The use of magnesium tooling plate increases rapidly as more and more plants discover its important benefits. Weight savings, precision flatness, fast machining and dimensional stability are reasons for its use in many applications. Take Boeing, for example . . .

Magnesium tooling plate and extruded channels are in widespread use at Boeing's Renton, Washington, plant where the new 707 jet airliner is manufactured. Welded magnesium plate and channel are used as parts for an overhanging wing jig (see photo). Because of magnesium's lightness, such locators can be long and yet be rigid. Furthermore this lightness results in a less



severe load on the basic structure permitting it also to be lighter and less expensive. Other magnesium jigs which can be positioned and put in place by hand can easily be positioned without mechanical equipment. If made of steel, a sizable working party or a crane would be needed each time they were moved.

The top of a 20′ x 20′ master template table at Boeing was constructed of two thicknesses of 1½″ magnesium plate. No machining was required on the plates, permitting a substantial cost savings over a previous master template table made of steel plate, which required considerable machining. The stability of magnesium has maintained the necessary tolerances during use. A large 707 door locating jig also made of magnesium tooling plate can be handled by two men, and can be easily stored when not in use. The stability of welded magnesium structures in this and other applications is invaluable for large assembly jigs.



* * *

The lightness, flatness, stability and stiffness of magnesium tooling plate have likewise greatly increased its use as a base plate for plaster forms.

There are other advantages that make lightweight magnesium desirable as tooling plate material: Manually positioned welding jigs are easier to handle, weld spatter doesn't stick, high heat conductivity prevents warping from local heating, and nonmagnetic magnesium used for spot welding jigs causes no interference. Wherever magnesium tooling plate is used, it means less frequent use of lift trucks and other power handling equipment.

* * *

NEW MAGNESIUM TOOLING PLATE MANUAL. This handy, fact-filled reference book covers shop working characteristics, properties, design, etc., for magnesium tooling plate and tubing. For your copy, contact any Dow sales office or write THE DOW METAL PRODUCTS COMPANY, Sales Department 1339F11-16, Midland, Michigan.

MACHINING TIME CUT TO SHREDS

Drilling, milling, reaming, sawing and other machining operations can be performed on magnesium with surprising economy. Magnesium machines faster and easier, reducing production time and tool wear to a minimum.

LONG SUIT: WELD STRENGTH

Magnesium tooling plate is easily joined by inert gas arc welding. High strength welds and joint efficiencies up to 95% are common. Any joint commonly welded with steel can be welded with magnesium, allowing exceptional versatility for tooling jobs. Magnesium can also be joined by common methods of mechanical fastening.

MAGNESIUM TOOLING PLATE IS AVAILABLE FROM STOCK AT:

E. F. Bailey Company
Seattle, Washington

Clendenin Bros., Inc.
Baltimore, Maryland

Copper and Brass Sales, Inc.
Cleveland, Ohio; Detroit 12, Michigan

Fullerton Steel and Wire Company
Chicago 35, Illinois

Hubbell Metals Inc.
St. Louis 3, Mo.; Kansas City, Mo.; Marietta, Ga.

A. R. Purdy Co., Inc.
Lyndhurst, New Jersey

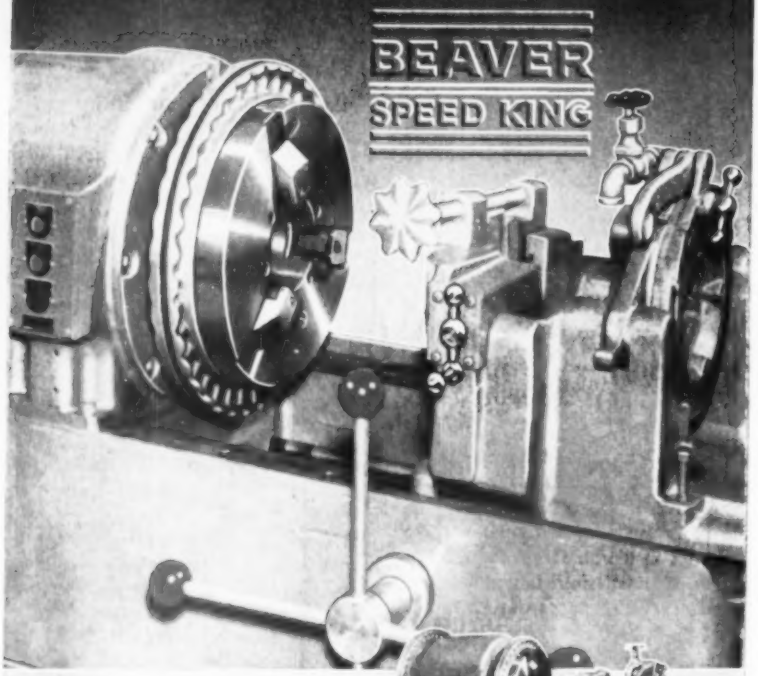
Reliance Magnesium Company
Los Angeles 58, California

Joseph T. Ryerson & Son, Inc.
Dallas, Texas

THE DOW METAL PRODUCTS COMPANY, Midland, Michigan

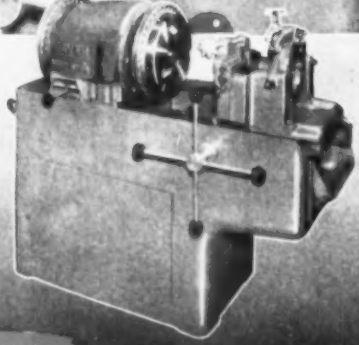
DIVISION OF THE DOW CHEMICAL COMPANY

THREADS 1 TO 4-INCH PIPE WITH... NO DIE CHANGE!



Only BEAVER HAS IT!

Only 980 lbs.!



BEAVER

Send for complete catalog and name of nearest distributor

PIPE TOOLS, INC.

DANA AVE.
WARREN, OHIO

walled stainless steel forging, with a ± 0.002 on the pitch diameter. Pitch was 16 tpi, length approximately 1½ in.

Horspool and Romine Mfg Co, Oakland, Calif

MORE DATA? Circle 103, inside back cover

Variable Pitch V-Belt Pulley Has Micrometer Adjustment

A 3¼-in. diameter variable pitch V-belt pulley, with micrometer adjustment to set pitch to required rpm, can be used with ⅜, ½, and ⅝ in. top V-belts.

Each half of the pulley is fastened directly to the motor shaft to eliminate misalignment. After one half of the pulley is loosened from the shaft, it is adjusted by turning a socket cap screw on the end of the hub. When the setting is reached, the screw is tightened to secure the variable half to the shaft.

This method of adjustment is said to assure better concentricity, and reduce belt hop and side wobble. It is available in ½ to ⅝ in. bore sizes.

Congress Drives Div, Tann Corp 3750 E Outer Drive, Detroit 34, Mich

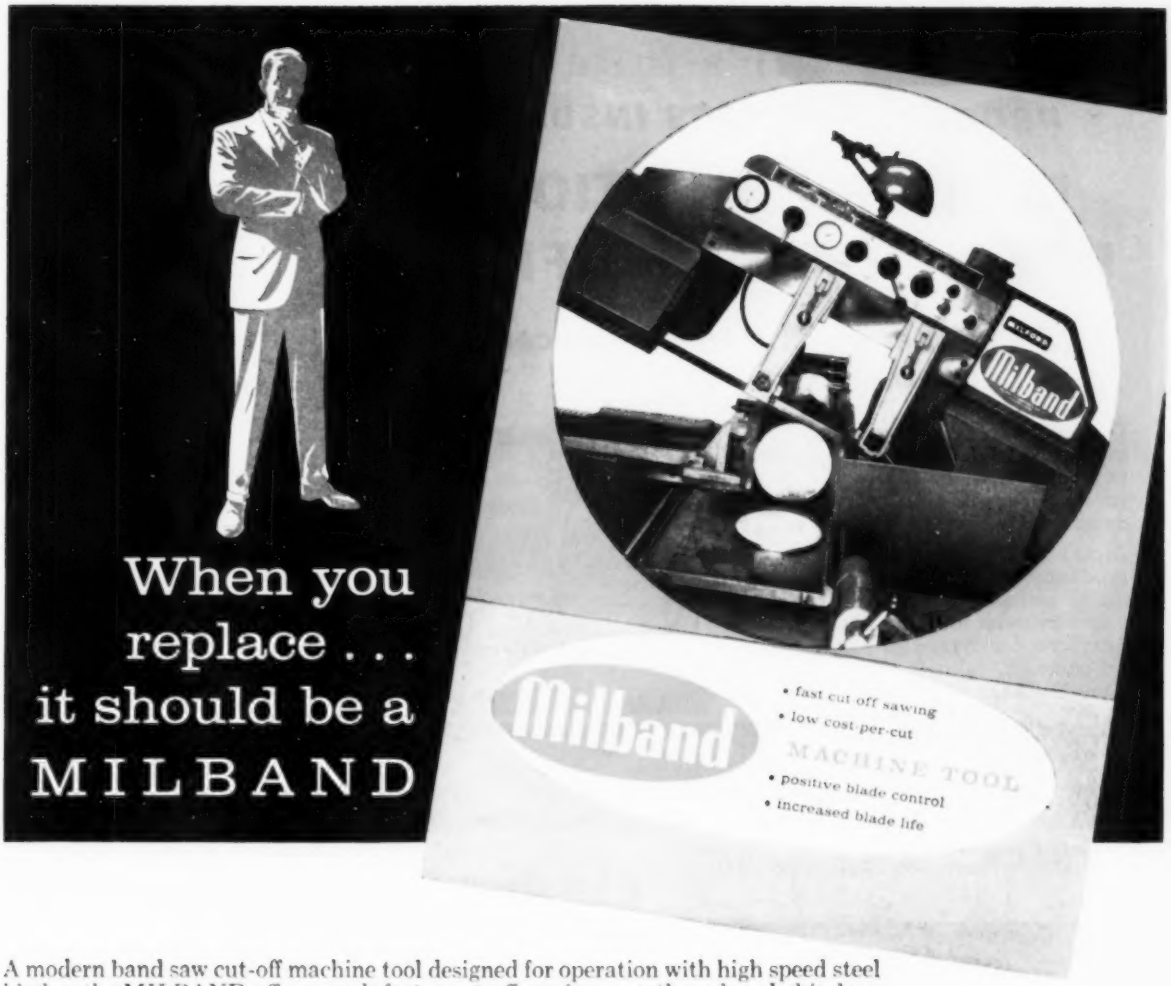
MORE DATA? Circle 104, inside back cover

New Drill Breaks Chips To Manageable Size

Lo-Tork chip breaker drills are available in sizes of ¾ of an inch and larger. Regular taper shank series are designated 110-LT; straight shank, 120-LT. Said to outperform regular drills which have been altered to include conventional types of chip breakers, design prevents clogging of flutes and permits increased flow of coolant to drill point. Drills retain positive rake at cutting lip and penetrate easily, even on heavy-duty jobs.

Chicago-Latrobe, 411 W Ontario St, Chicago 10, Ill

MORE DATA? Circle 105, inside back cover


When you replace . . . it should be a MILBAND
Milband
• fast cut off sawing
• low cost per-cut
MACHINE TOOL
• positive blade control
• increased blade life

A modern band saw cut-off machine tool designed for operation with high speed steel blades, the MILBAND offers much faster cut-off sawing, greatly reduced chip loss, and cuts consistently smoother, straighter and more accurately. *Your* next investment in cut-off equipment *should* be a MILBAND!

The circular featured above covers all the important facts about the many advantages offered by continuous-action band sawing. It also covers all the design and construction features that make the MILBAND Machine Tool today's (AND tomorrow's) wisest investment in a cut-off machine. Use the coupon below to send for your free copy, and check the facts for yourself. If you want additional dollars-and-cents proof, we'll be glad to run actual tests on a MILBAND Band Saw Machine Tool and submit a complete time-and-cost analysis report.

MILBAND MACHINE TOOL DIVISION

THE HENRY G. THOMPSON & SON CO. NEW HAVEN 5, CONNECTICUT

Saw Specialists For Over 80 Years

SAW & BAND SAW BLADES • STOCK • HACK • MILFORD • SAWS • GROUND FLAT

FILL IN AND MAIL TODAY!

THE HENRY G. THOMPSON & SON CO.
271 Chapel St, New Haven 5, Conn.

☐ Please send my free copy of the MILFORD circular giving complete information on the modern, band saw cut-off method with the MILBAND Band Saw Machine Tool.

name_____ position_____

company_____

co. address_____

city_____ zone_____ state_____

HOW B. Jahn

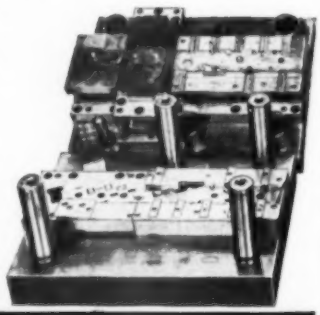
PROGRESSIVE DIES INSURE

MASS PRODUCTION PRECISION & PROFITS

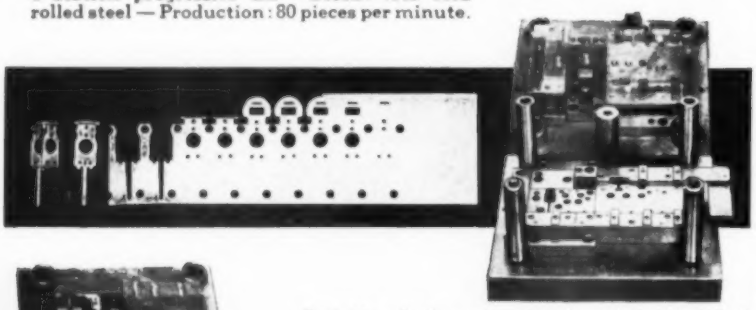
3 Cylinder Lock Parts Produced with Speed and Economy!

The ingenuity and precision designed into these B. Jahn Progressive Dies pays off in **speed, economy** and **precision** for millions of **mass** produced components.

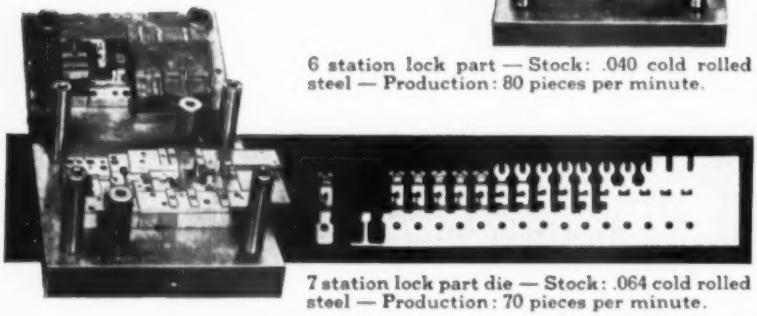
In addition to eliminating many costly production operations, the parts produced make up interchangeable precision cylinder lock assemblies, mass produced for maximum service with economy. B. Jahn Dies may be the **Key** to your product profit problems.



8 station progressive die — Stock: .040 cold rolled steel — Production: 80 pieces per minute.



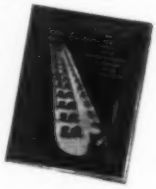
6 station lock part — Stock: .040 cold rolled steel — Production: 80 pieces per minute.



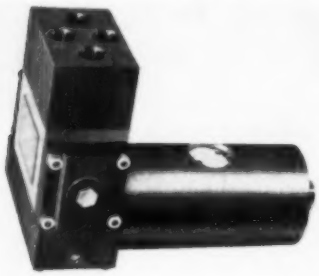
7 station lock part die — Stock: .064 cold rolled steel — Production: 70 pieces per minute.

B. Jahn

Send for B. Jahn Brochure Today—



THE B. JAHN MANUFACTURING COMPANY, NEW BRITAIN, CONNECTICUT



Standard Hydraulic Probe Unit Designed for Single Axis Tracing

Unit is made for tracer controlling on any type of machine tool. The extremely sensitive probe is equipped with a Pegasus hydraulic servovalve. Reported to be highly accurate, combined hysteresis and dead space is under 50 millionths of an inch.

Two models are offered with probe stable at operating pressures from 200 to 3000 psi. At 1000 psi Model TC-320 has a capacity of 5 gpm with flow rate of 1 gpm per 0.001-in. stylus deflection. Model TC-340 operates at a capacity of 10 gpm with flow rate of 2 gpm per 0.001-in. deflection. Operating temperatures range from 60 to 120 F normal. Solenoid deenergize retract is available if desired.

Tracer Control Co, 595 E Ten Mile Rd, Hazel Park, Mich

MORE DATA? Circle 106, inside back cover

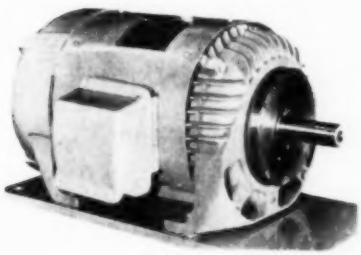
Roller Bearing Series Has New Cage Design

Series HJ channel-shaped outer ring roller bearings' cage design permits application at speeds higher than those attainable with full complement types. Longer and larger rollers in these standard inch-size bearings result in greater capacities than previously available. Furnished in sizes from $^{3}/_{4}$ to 4-in. bore, bearings may be applied directly to hardended and ground shafts or used with inner rings. Boundary dimensions conform to standard AFBMA series NAA and NAB and the bearings are interchangeable with needle bearings made to these standards.

One-piece cage design separates roller guiding and roller retaining functions by employing a cage bar depressed within the roller pitch circle. Roller guidance takes place at ends of rollers and at the pitch line where guidance is accomplished with minimum friction. Rollers are retained by the middle portion of the cage bar which is always out of contact with the rollers during operation, preventing dissipation of lubricant common with ordinary cylindrical cages.

Torrington Co, Torrington, Conn

MORE DATA? Circle 107, inside back cover



Precision Wheelhead Motor For Grinding Wheel Applications

Motor is obtainable in frames 213 through the 256-U, totally enclosed fan-cooled. It is constructed to isolate 120-c vibration that is produced in the magnetic iron, thus eliminating a cause of blemishes on the ground surface of the work. Standard NEMA mounting dimensions are retained in this special design.

Rotor is balanced to 0.0001 in. An external means is provided for balancing the rotor to eliminate disassembly for final balancing. This allows balancing on its own bearing and with the bearing properly sealed. Max shaft runout is held to 0.00025 in. Unit can be used for other high-precision motor applications.

Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Penna

MORE DATA? Circle 108, inside back cover

Universal Nut-Cracker Handles All Sizes

NC-50 weighs 1 lb 5 oz, measures 6-3/4 in. over-all, and is designed to reach and crack every size of nut on a car body or frame. It handles all

Questions from the floor

Are you getting most floor absorbent bulk (not weight!) for your money?

Does your floor absorbent become saturated before it does its job?

Does your floor absorbent create new hazards by absorbing light, thus reducing needed working light?

Does your floor absorbent "mud up" with oil and water?

THERE'S A TEST THAT ANSWERS ALL THESE QUESTIONS

In less than 15 minutes in your own office, you can get all the right answers scientifically. Our Eagle-Picher representative will bring a miniature laboratory right to your desk. Compare Eagle-Picher Floor-Dry with any other floor absorbent. See which wins out on overall economy and full-range safety. Eagle-Picher is eager to face comparative tests. Write today.

Since 1843

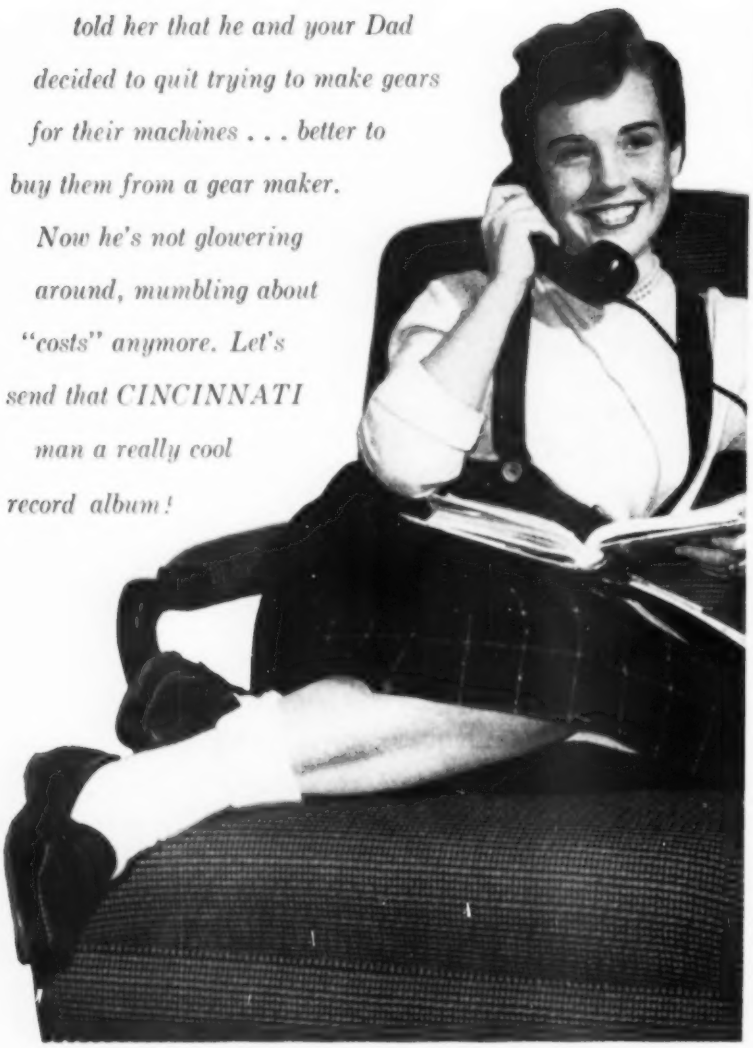
EAGLE EP PICHER

EAGLE-PICHER

The Eagle-Picher Company
Dept. AM 1116, Cincinnati 1, Ohio

Mine too...

That's right, Lois. Mom says Dad told her that he and your Dad decided to quit trying to make gears for their machines . . . better to buy them from a gear maker. Now he's not glowering around, mumbling about "costs" anymore. Let's send that CINCINNATI man a really cool record album!



CINCINNATI gears cut your costs ALL the way—
Precision inspection saves your in-plant checking costs . . . Guaranteed delivery dates cut production delays . . . Consistent quality reduces assembly costs . . . High machine utilization means lower gear prices to you.
Send prints for quotation on your gears and custom gear boxes.

CINTI®

THE CINCINNATI GEAR CO.

Wooster Pike and Mariemont Ave. Cincinnati 27, Ohio
Custom Gear Makers Since 1907

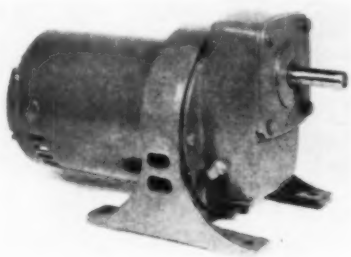
GEARS, good gears only

sizes from 5/16 to 13/16 in. (across the flats) without damage to the bolt.

Unit operates by chisel action, building up to 25,000 lbs of cracking pressure. Double offset design enables a mechanic to lay it on any nut in any position and still have wrench room to turn the pressure forcing screw at the bottom. Price is $7.95.

Craft Tool Co. 1524 Fairmount Ave, Philadelphia 30, Penna

MORE DATA? Circle 109, inside back cover



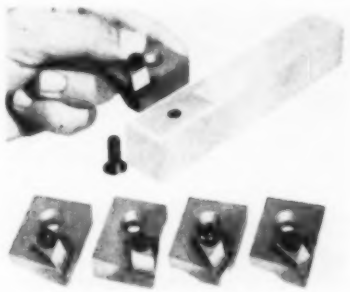
GE Extends fhp Gear Motor Line With Lightweight 1/8-3/4 hp Models

New ac models are right-angle and integral-type designs with output speeds, respectively, of 197 down to 6 rpm, and 780 to 13.5 rpm. Where they replace older designs they are lower in price.

Company has also designed a new fractional hp motor-mounted brake. Rated 3 lb-ft of torque, it is approx 30% lower in price than previous design. Principal applications of the line are in the materials handling, machine tool, and food machinery industries.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 110, inside back cover

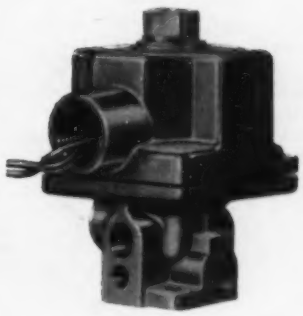


Tool Holder Introduced With Disposable End

Turning tool holder that attaches to a conventional shank by a screw is designed with a disposable end which holds a throw-away carbide tip. When an operator spoils a holder only the end is discarded. End-O-Con line of ends is especially designed

For versatile Cylinder Control, specify Skinner 3- and 4-way Solenoid Valves

For small cylinders . . . Skinner V5 and V10 air and hydraulic valves. Stainless steel construction. Mount in any position; can be cleaned without removal from line. Pressure ratings to 1000 psi. Available normally open, normally closed, directional control, multi-directional, quick exhaust. Orifice sizes: 3/64" to 1/4".



For medium cylinders . . . Skinner 3 way A Series valves. A new line that can also be used to operate smaller cylinders calling for increased cycling speeds. Die-cast, zinc body; stainless steel internal parts; mount in any position. Available normally open, normally closed, directional control. Pressure to 125 psi; orifice size, 5/32".

Coming soon . . . for larger cylinders! A new-design, general purpose, high-flow industrial line of 3-way solenoid valves. These new valves will be available in orifice sizes of 3/8", 1/2" and 3/4" and will be offered normally open, normally closed, or directional control in standard and explosion-proof construction. Operating pressures: 5 to 150 psi.

For double-acting cylinders . . . Skinner 4-way V9 valves. Two 3-way valves in one housing offered normally closed-normally closed, normally open-normally open, and normally closed-normally open. Available with adjustable flow features for exceptional cylinder control. Orifices: 3/64" to 1/8". Pressure ratings to 200 psi.

Exhaustive lab tests assure that you can use any Skinner valve with confidence. Built to the highest UL standards, Skinner valves are completely tested and checked to provide the best product available. Skinner's testing standards meet or surpass those of the aircraft industry.

A complete line of 2-, 3- and 4-way solenoid valves. There's a Skinner valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from 3/64" to 1". Pressure ratings range from vacuum to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.

Skinner solenoid valves are distributed nationally

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 30N

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY **THE SKINNER ELECTRIC VALVE DIVISION • NEW BRITAIN, CONNECTICUT**

MARKING METAL?

Blaisdell markers do the trick

CHINA-MARKER

Unsurpassed for bold, bright marking on all surfaces. Strong and durable—adheres firmly—14 vivid colors.

OMNIMARK—Thinner diameter lead for fine line marking.

DU-ALL
MECHANICAL PENCIL

Convenient propel-repel action. 8 brilliant, all purpose leads with barrels to match.

AT BETTER STATIONERS EVERYWHERE

Test the marker that suits your needs. Send for sample naming this publication.

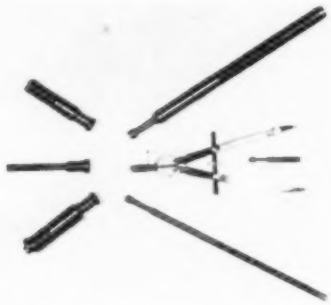
blaisdell
PENCIL COMPANY
BETHAYRES, PA.

for cast iron work and utilizes a chip breaker clamp. Since there is an end for every standard lead angle, operator merely removes one end and replaces it with the next desired lead angle end; all are interchangeable on the same shank.

The End-O-Cut line, with same features as the End-O-Con, is suited for both cast iron and more difficult turning and facing operations; it utilizes a throw-away carbide chip-breaker.

Ends Co, 515 Luett Ave, Indianapolis, Ind

MORE DATA? Circle 111, inside back cover



Portable Broaches Offered For Fixed or Portable Machines

Series of 28 portable broaches incorporates a segmented helical pattern of cutting teeth to generate the full diametral cut, followed by a series of closely pitched finish teeth. Combination produces a maximum amount of stock removal with an extremely fine surface finish and long tool life. Tools are suitable for broaching aluminum, steel, laminates, in diameters from 0.250 to 0.6562 in.

California Broach Co, 664 S Anderson St, Los Angeles, Calif

MORE DATA? Circle 112, inside back cover

Double-Acting Depth Gage Simplifies Groove Location

New Mueller depth gage determines location of either internal or external grooves. It measures tapers

a
new approach
to
bigger savings in metalworking!

MULTI-USE,

SOFT RUBBER BONDED ABRASIVES

The ONLY Complete, Comprehensive STOCK LINE!

Achieving a Unique, Rubber and Abrasive Action

Simultaneous
BURRING • FINISHING
CLEANING • POLISHING

bridging the gap between the grind and buff frequently *in one operation!*

Wheels • Sticks • Rods • Blocks

JOB-MATCHED to your machine and manual operations. Exceptionally suited to automation production.

Ask your dealer or write us now for:
- CATALOG OUTLINING APPLICATIONS
- NEW METHOD RECOMMENDATIONS
- SAMPLE BRIGHTBOY HAND TABLET

Draw on your dealer's stock or on our complete factory stock. *Fast deliveries!*

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.
95 North 13th Street Newark 7, N. J.

America's Pioneer Manufacturer of Rubber-Bonded Abrasives.

WELDON ROBERTS
Brightboy
RUBBER CUSHIONED ABRASIVES

CIRCLE 299 READER SERVICE CARD

CIRCLE 300 READER SERVICE CARD

ONE important feature of automatic production is **the storage of shape in dies.** This is also the basis of closed die forging—"drop forging". **Chambersburg,** pioneer builder of equipment for making drop forgings, today builds tools that will shape forgeable materials to close tolerances by a combination of carefully designed die configurations, with precisely controlled forging blows and a fixed pattern of mechanized stock manipulation. When used with complementary shearing, heating, and trimming equipment, **fully automatic or semi-automatic production lines** are created which are capable of **increased output at lower costs.**

CHAMBERSBURG ENGINEERING CO.
CHAMBERSBURG • PENNSYLVANIA

A new publication, "The Automatic Production of Forgings in Closed Dies" provides the latest information on how to adapt these new developments to your drop forging operations. Write today for Bulletin 87-L-9.

CHAMBERSBURG

"THE HAMMER BUILDERS"
•
Designers and Manufacturers of
THE IMPACTER

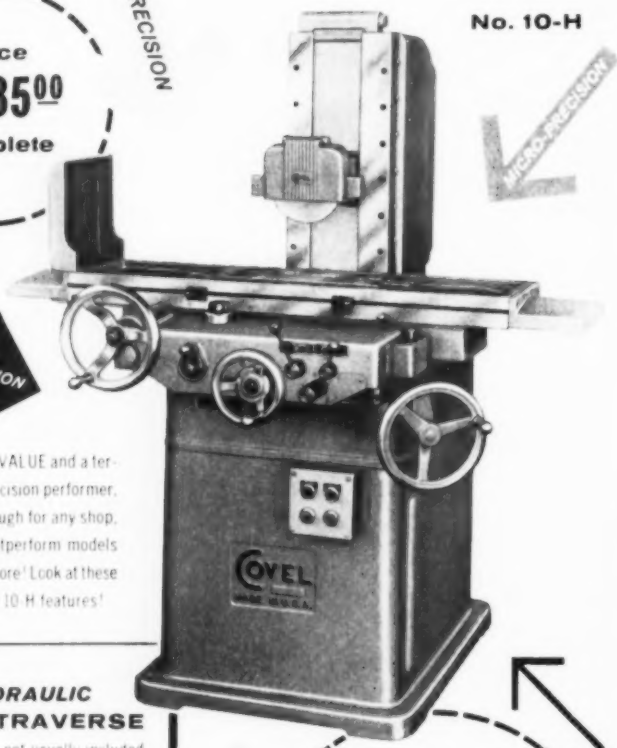
NEW HYDRAULIC

6"x18" SURFACE GRINDER

No. 10-H

MICRO-PRECISION

Price $2985.00 Complete



MICRO-PRECISION

MICRO-PRECISION

A tremendous VALUE and a terrific micro-precision performer. Priced low enough for any shop, but built to outperform models costing much more! Look at these superior Covel 10-H features!

HYDRAULIC
RAPID TRAVERSE

A plus feature not usually included on a grinder under $3000 price range. Saves time in work positioning. Adjusts to slower speeds for wheel truing.

ALL-NEW
HYDRAULIC SYSTEM

Under test and development for more than four years. Covel's unique, simplified hydraulic system brings you all the benefits of hydraulic feed for less while maintaining top performance . . . table speeds from 10 to 70 ft. per minute.

MICRO-PRECISION

BIG 16½" VERTICAL CAPACITY

Extra vertical capacity lets you do more jobs on the Covel 10-H, even those extra-tall jobs most grinders won't touch.

HYDRAULIC
HIGH SPEED TABLE

Infinitely variable hydraulic feed from 10 to 70 ft. per minute or may be hand fed. Cross feed also infinitely variable, rapid or hand, from .005" to .250".

Micro-Precision a Covel Tradition-Since 1874

COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write, wire or call TODAY for complete information and prices on the 10-H and the complete line of Covel Precision Grinders. Ask for Bulletin AM-229.

with a special taper attachment; by adding a measuring ball it becomes a pin gage.

Direct measurements may be obtained for both location and width of the groove in one operation by means of a dial indicator that accurately measures the travel of the footed rod. Release pin located on the side of the gage body permits measuring in either direction from the measuring anvil. Both straight and footed rods of various lengths increase the range of the instrument and may be interchanged in a few seconds. Straight rods are provided so that it may be used as an ordinary depth gage.

Mueller Gages Co, 1052-1058 N Allen Ave, Pasadena, Calif

MORE DATA? Circle 113, inside back cover

Combination Tool Can Be Used As Drill or Power Screwdriver

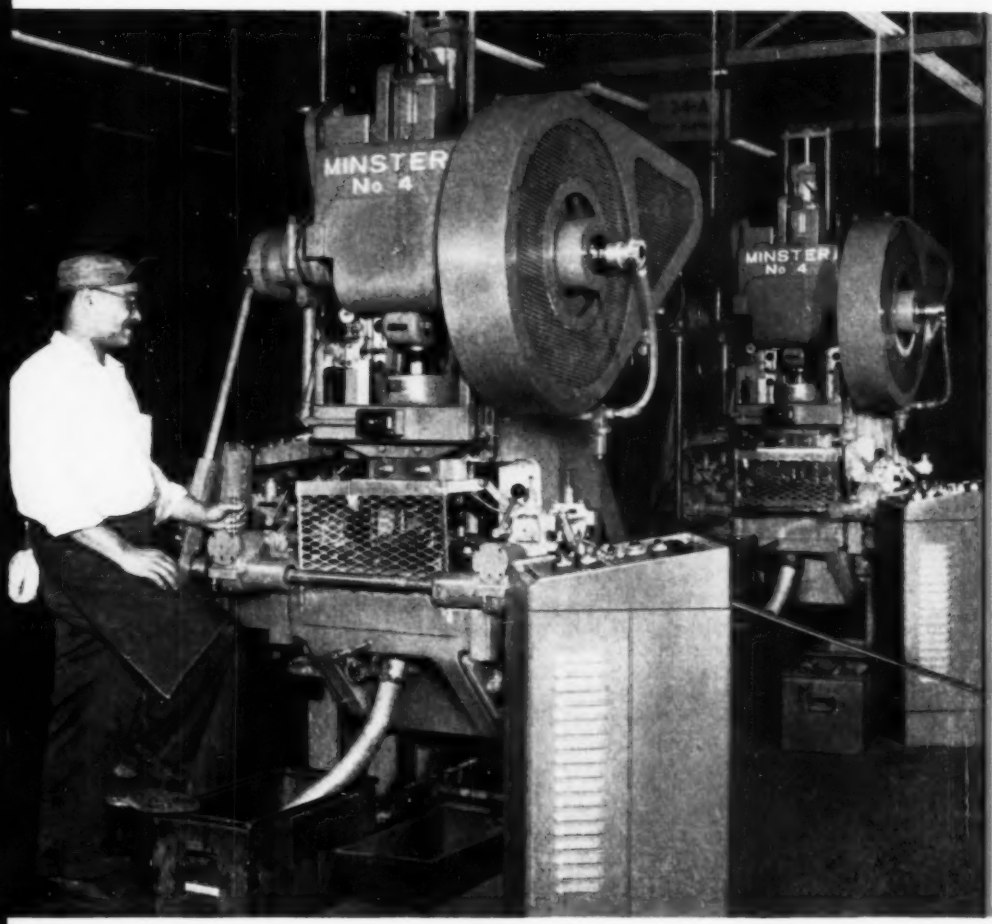
Scru-Drill, when applied as a drill, can be used with all kinds of bits including twist drills up to $\frac{5}{8}$ in., wood augers to $\frac{3}{4}$ in.; masonry bits up to $\frac{1}{2}$ in.; and hole saws from $\frac{3}{8}$ to $1\frac{3}{4}$ in. Turn of the spindle collar on the tool converts it to an equivalent of the Black & Decker Scrugun with a true screwdriving clutch. As in the Scrugun, the bit idles for finding the screwhead slot, then forward pressure of the tool engages the mechanism and drives the screw. As soon as the screw is properly seated, release of driving pressure disengages the clutch, halting the drive to prevent any marring of work surface. Unit can also be used for running up nuts by using shanks and sockets. Reversing switch permits quick removal of screws or nuts in disassembly operations.

Black & Decker Mfg Co, Towson 4, Md

MORE DATA? Circle 114, inside back cover

AUTOMATIC PRODUCTION

gives you maximum press efficiency, less handling



Minster O.B.I.'s ranging from 12 to 110 tons capacity give superior performance on automatic production because of close bearing clearances, heavy, rigid frames, precise gib fitting and fast controlled action of the Minster clutch and brake.

Photos courtesy of Automatic Electric Company, North Lake, Illinois

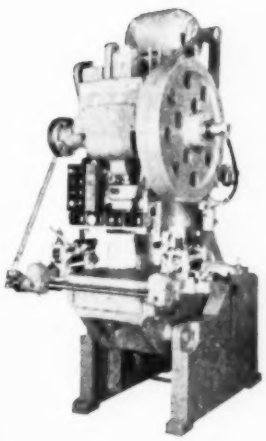
Minster Feed Equipped O.B.I. Presses

Costs decline rapidly when stampings are produced automatically. Speeds are higher, parts more accurate, presses run at top efficiency.

Automatic production . . . long or short run . . . is *most* profitable when done on a Minster press because every Minster press has the inherent precision and stability needed for this type of work.

Minster can provide the right press equipped with job-matched feed to assure you of maximum productivity and savings.

Want to investigate the possibilities? Write or call us today.



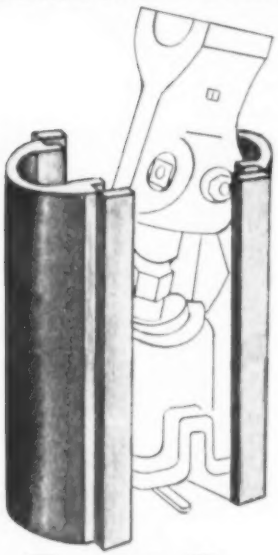
The Minster Machine Company • Minster, Ohio

MINSTER®

CIRCLE 303 READER SERVICE CARD

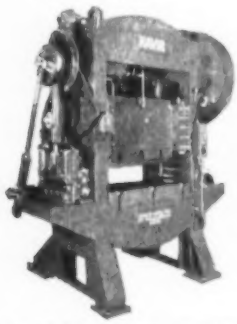
Exclusive
Cylindrical Type Ram gives you Longer Die Life on

HAVIR
(formerly Diebel)
HI-PRODUCTION
AUTOMATIC PRESSES



MORE BEARING FROM EVERY ANGLE

Costly Carbide Dies wear longer because extra bearing area supporting the ram from every angle provides more rigidity and precision than conventional Vee ways. HAVIR Presses also have extra crankshaft bearing area to reduce crank deflection. Cut down time, add die life with HAVIR Hi-Production Automatic Presses.

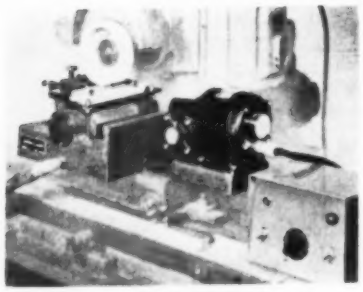


HAVIR 200 TON
Other models from 5 Ton.

For O.B.I. Presses investigate PRESS-RITE Presses, 2 Ton to 85 Ton. Write for descriptive Bulletin 958.

Sales Service Mfg. Co.

Sales Service Mfg. Co.
2361 University Ave., St. Paul 14L, Minnesota

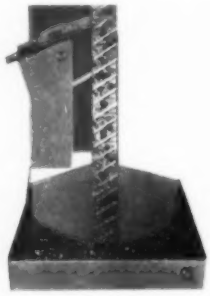


Grinder Attachment Converts Surface Grinder for Various Jobs

Portable grinder attachment converts any surface grinder into a precision OD, ID, and centerless grinder. Exceptional speeds and unconventional cuts are reported to be obtainable with corresponding savings on both occasional jobs and production runs. Rough turning operations have been eliminated in many cases. For centerless grinding, work rests on a motor-driven regulating roller which is carried on extra-capacity precision bearings. Infinitely variable control adjusts the roller speed. For plunge grinding, a hold-down bracket is inserted into the unit; this holds the work and no chucking or indicating is required. Concentricity is assured automatically with the diameter on which part is held. Cooling pump is furnished.

Unison Corp, 2843 Hilton Rd, Ferndale 20, Mich

MORE DATA? Circle 115, inside back cover



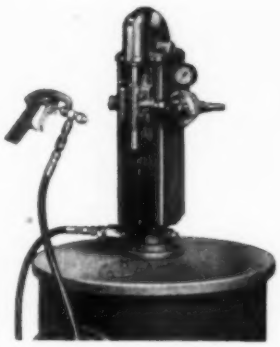
Orienting Belt Elevator Handles Rolling or Sliding Parts

Unit has variable speed drive and is available with or without demand-feed control. Discharge can be RH or LH and height is adjustable.

Elevating mechanism consists of a motor-driven steel chain belt with steel cleats which carry the parts up to the discharge chute into which they roll or slide, completely or partially oriented, depending on shape of part. When further orientation is required, special RCA tracking devices can be attached to the discharge chute. Storage capacity of the hopper is 15 cu ft; hopper can be provided in larger and smaller sizes. Unit can be used to feed rotary and vibratory hoppers or to feed parts directly into production and assembly machines.

Radio Corp of America, Industrial and Automation Div, 12605 Arnold Ave, Detroit 39, Mich

MORE DATA? Circle 116, inside back cover



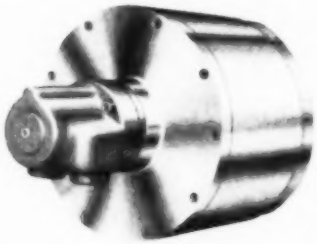
New Spray Painting System Requires No Atomizing Air

Material in No-Air Dyna-Spray system is atomized by hydraulic pressure. Advantages include elimination of heating of material; reduction of material in the atmosphere, minimizing need for extensive ventilation; use of smaller compressor.

Four nozzles offer a variety of spray angles from 15 to 80°. Heavy-duty spray gun weighs 12 oz and has a trigger that can be locked in open position for continuous spraying. Powered by a Power-Master pump, the unit produces a pulsation-free spray pattern at pressures from 400 to 2000 psi.

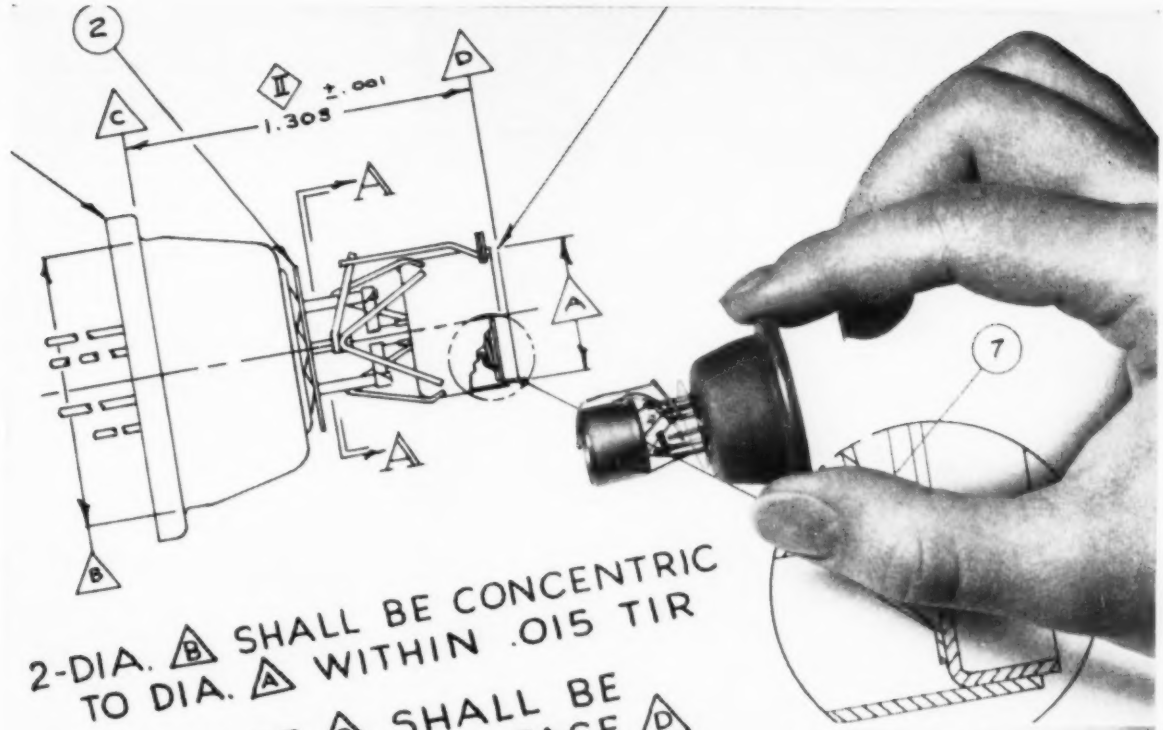
Lincoln Engrg Co, 5010 Goodfellow Blvd, St Louis 20, Mo

MORE DATA? Circle 117, inside back cover



Rotating Air Cylinder Designed For Use at Speeds up to 3600 rpm

Model RM, available in 3 to 16-in. bore sizes, has extra long stroke providing added power when serv-



"We can cut out up to 20 gaging operations on delicate parts like this."

"Many times, with a single chart and fixture on our Kodak Contour Projector, we can quickly inspect several complex part dimensions at a single pass. This cuts gaging operations and costs to a fraction of the cost of separate gaging checks," says Varian Associates of Palo Alto, Calif., makers of precision electronic parts and equipment.

No contamination of or pressure on delicate parts (a light beam exerts no pressure, causes no wear); high-speed, accurate inspection of close-tolerance dimensions; few mechanical operations . . . these are only some of the reasons why manufacturers like Varian find optical gaging with the Kodak Contour Projector the most practical solution to many inspection problems.

You get more with a Kodak Contour Projector. You get greater *working distance*—8" of clearance for parts and fixtures. Especially important at high magnifications.

You get more brilliant, more uniform *illumination* over the entire screen area—at all magnifications.

You get highly *accurate images* even at the critical outer edges of the screen area.

You get *upright images* of all inspected parts for easier reference.

These and other features of the Kodak instrument make it more efficient and more valuable to you. Read about them by writing for the booklet, "Kodak Contour Projectors."

SPECIAL PRODUCT SALES

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

THE KODAK CONTOUR PROJECTOR

Kodak
TRADE MARK

They are made to provide smooth, more efficient transmission of power and are available from stock in 13 sizes with bored or solid hubs ranging from .375" to 4.000". Special bores, bores with keyways or setscrews are available upon special order.

The close limits to which all parts are held assure maximum load carrying capacity with durability and long life. All parts are made of preheat-treated alloy steel and are precision ground to insure high quality and interchangeability of components. Joints with hub diameters of .750" and larger have a self-closing snap ball oiler while the small pin is held in place with a self-locking snap ring. The snap ring simplifies assembly and disassembly.

Send today for Bulletin No. 527 describing the full line of ASG Universal Joints available from your nearest distributor.

AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY **HARVEY, ILLINOIS, U.S.A.**

ing as actuator for chucks, collets, and other rotating holding devices. Strokes other than standard are also available.

Built with housings and covers of aluminum alloy, low weight and lessened flywheel effect reduce the load on machine's motor, clutch, and brake. Model incorporates a special double bearing inlet to provide longer life at higher speeds and faster operating response. Special inlet packing adjusts itself automatically through working pressure, further reducing maintenance.

S-P Mfg Corp, 30201 Aurora Rd, Solon, Ohio

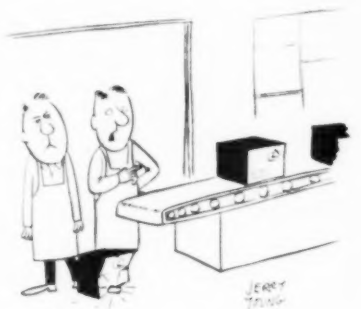
MORE DATA? Circle 118, inside back cover

Hand Lapping Tool Line Offered For Carbide and Steel Tools

Tetrabor hand lapping tools for sharpening and lapping carbide and hardened steel tools have working area made from selected boron carbide which approaches diamond in hardness. Cutting tools can be easily dressed or lapped without removing them from machine or holder. Cutting portion of the tool is securely fastened to alloy holder with synthetic resin cement. Lappers are available in three shapes, flat, ½ round, or triangular, in two grit sizes, 220 or 400. Each is priced at $9.80.

Titan Tool Supply Co, Box B, 1419 Hertel Ave, Buffalo 16, NY

MORE DATA? Circle 119, inside back cover



"You took one . . . then I took one . . . then you took one . . . You're right, that one was mine!"

At Raytheon Mfg. Co. . . .

Grinding non-ferrous materials to fine tolerances!

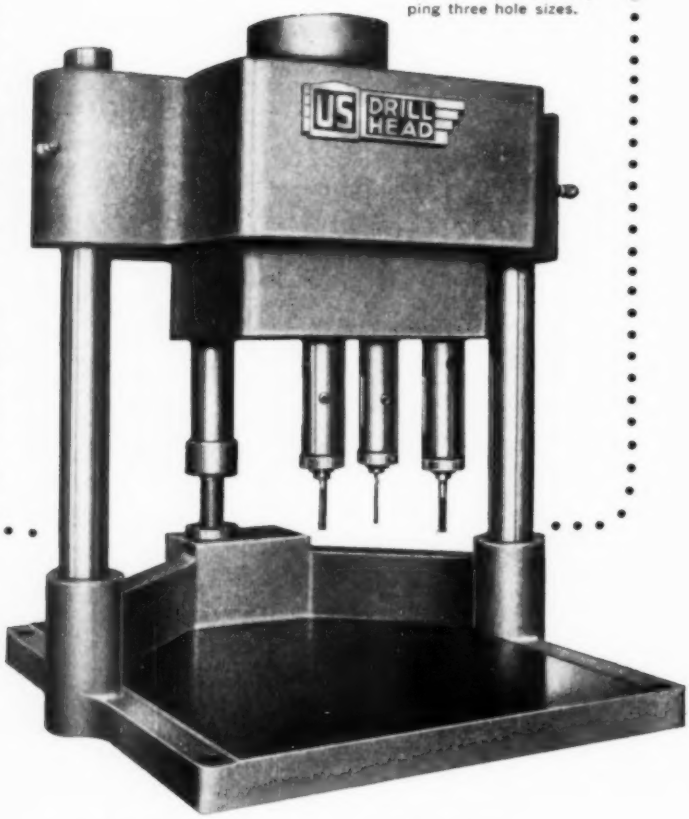
This leading manufacturer of electronic systems uses new hard ceramics as microwave system components. These extremely tough materials presented a difficult grinding problem. It was solved by using diamond abrasive wheels on Blanchard No. 11 grinders. The results were outstanding: Disks measuring approximately 2¼" x ¼" were ground to a tolerance of ±.001", with ⅛" of material removed. Flatness is .002", parallelism .002". These parts are ground at the rate of 48 per hour, and surface finish is consistently excellent.

Write for your copy of "Work Done on the Blanchard".
THE BLANCHARD MACHINE COMPANY
64 State Street, Cambridge 39, Mass., U. S. A.

BLANCHARD

RESEARCH *must be implemented!*

3-spindle U. S. Fixed Center Head with auxiliary lead screw tapping spindle for precision tapping three hole sizes.



. . . and, that's the business of manufacturers.

In practically all manufacturing, the most common operation is the production of holes. And, for cost-reducing production of precision multiple-hole patterns in your manufacturing— that's OUR BUSINESS!

Get low-cost

MULTIPLE-HOLE LEAD SCREW TAPPING ON A DRILL PRESS with U. S. Heads

Where precision tapping of multiple-hole patterns is required on high or low production runs, do the job on a drill press with a U. S. Master Lead Screw Head. These special fixed center heads are built with varying number of spindles and tap sizes in any one head—exact gear ratio required to each spindle as well as to master lead screw. Use on any drill press having reversing spindle.

Ask Our Engineers To Talk With Yours

U. S. NAVY PHOTO

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

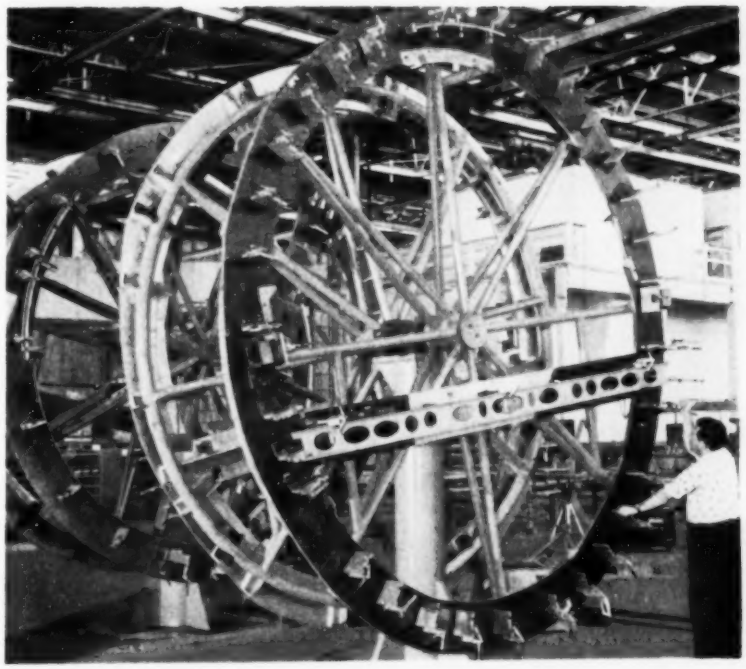
353

FIELD REPORT...

Hufford to Build Huge Spin Forge For Lockheed Aircraft

Siegler Corp's Hufford Div has an order in excess of $500,000 from Lockheed for a machine tool which will be the largest of its type in the world. The Spin Forge will produce missile and space vehicle components up to 8 ft in diameter and 20 ft long. The largest built to date, located at the Hufford plant in El Segundo, Calif, has a 72-in. diameter. Machine for Lockheed will have a 96-in. diameter and will be 40 ft high and 32 ft wide. Since it's too large for a conventional factory it'll be housed in a specially constructed building at the Missile and Space Division at Sunnyvale, Calif.

Machine, developed by Hufford to meet new requirements in component size, shape, tolerance, and materials created by recent advances in aircraft and missile technology, utilizes a combination of rolling and shearing principles to produce mechanically spun sections such as conical, tubular, and parabolic configurations with varied wall thicknesses.



Vertical space savers . . .

These belt frame and floor beam assembly fixtures occupy only a fraction of the space which would be required if they were built horizontally. Device is in use at Convair-San Diego Division of General Dynamics Corp in the Convair 880 jet transport manufacturing program. Convair-San Diego made the pinwheel assembly fixtures more versatile by mounting them on trunnion stands rather than on building structures such as pillars or balconies. They may be moved about to meet manufacturing requirements. A floor beam is on this fixture awaiting placement of a belt frame for assembly

General Mills Diversifies, Acquires Magnaflux Corp

Business and assets of Magnaflux Corp of Chicago, leading producer of non-destructive testing techniques and equipment, have been acquired by General Mills, Minneapolis. Magnaflux will continue in business at its present location and under the same name as a wholly owned subsidiary of GM.

General Mills' Mechanical Division, established just before WW II, specializes in manufacture, research, and development in electronics and electro-mechanics. R A Wilson, GM vice president and general manager of the Division, is new president of Magnaflux. F B Doane, former Magnaflux president and chairman of the board, will continue to serve the company as a consultant.

Topp Industries May Merge With United Industrial Corp

Plan of a merger of United Industrial Corp, New York, with Topp Industries Corp, Los Angeles, has been adopted by the directors and will be placed before stockholders of both companies for approval at special meetings scheduled to be held sometime this month. Both companies are engaged in research, development, and production for the missile and satellite programs and in the design and manufacture of a wide variety of products for industry and government. Consolidated company would represent total assets of $27 million and an annual sales volume in excess of $32 million, based on current operations of their constituent companies. Name of the merged companies would be United Industrial Corp.

Bendix Gets Rights for Magnesium Alloy Castings Process

Bendix Aviation Corp, Teterboro, NJ, has acquired from Magnesium Elektron Ltd of Manchester, England, a magnesium alloys patent license to manufacture, use, and sell in the US castings produced by the English firm's techniques. The metal alloys are used in such applications as castings for jet engine compressors, expansion chambers, and gear boxes, and high-pressure hydraulic equipment for missiles and high-performance aircraft. Included are rights to the Elektron alloys of the zirconium rare earth and thorium series, known as alloys Z5Z, ZRE1, RZ5, ZT1, and TZ6, and the new magnesium-silver-rare earth alloy MSR, reportedly the strongest magnesium alloy developed to date. Bendix will start using the casting techniques immediately.

Meehanite Metal Corp Purchased

Meehanite, New Rochelle, NY, has been purchased by Harry H Kessler & Associates, St Louis, Mo. Mr Kessler, who is president of Sorbo-Mat Process Engineers, St Louis, Sorbo-Cast Corp, New Brunswick, NJ, and Foundry Design Co, St Louis, will also become president of Meehanite. Oliver Smalley, former president, will remain with the new group as advisor and consultant. No change in location or method of operation is planned and Meehanite will continue to function as a separate company.

Sorbo-Mat provides a consulting service to foundries in the manufacture of ferrous and non-ferrous met-

10-DAY TOOL TEST

Discover how customized MASTER POWER AIR TOOLS are custom-sold, custom-installed and custom-serviced

Master Power Assembly Tools are fitted individually to your job, precision-built and can frequently be serviced on the spot. One tool with a choice of 122 attachments can do a wide variety of jobs. Light in weight. Exceptionally quiet running. Compact in design. Precision-built for long, hard usage. Mail coupon today for a 10-day tool test.

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Look under TOOLS-PNEUMATIC HOISTS-PNEUMATIC

Master Power Corporation, Dept. 211, Bedford, Ohio

Gentlemen: I want to run a Master Power 10-Day Tool Test. I understand there is no obligation.

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- ☐ I am interested in *Percussion Tools*
- ☐ I am interested in *Abrasive Tools*
- ☐ I am interested in *Air Hoists*

Company.....

Individual.....

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Field Report . . .

als in the control of specifications in cast metals. Sorbo-Cast performs similar services for firms making automotive castings. Foundry Design provides consulting services in foundry design, layout, reorganization, and modernization.

Howell Buys Leland

Howell Electric Motors Co, Howell, Mich, has acquired Leland Electric Co, Dayton, Ohio, manufacturer of 1200 different specifications of electric motors. Acquisition means Howell now has three wholly owned operating subsidiaries and four manufacturing plants. Ohio Electric Manufacturing Co and its subsidiary, Kingston-Conley, were acquired earlier this year. Leland, a former American Machine & Foundry division, does an annual business of between $7 and $8 million, employs about 500.

Ano-Coil to be Produced in US

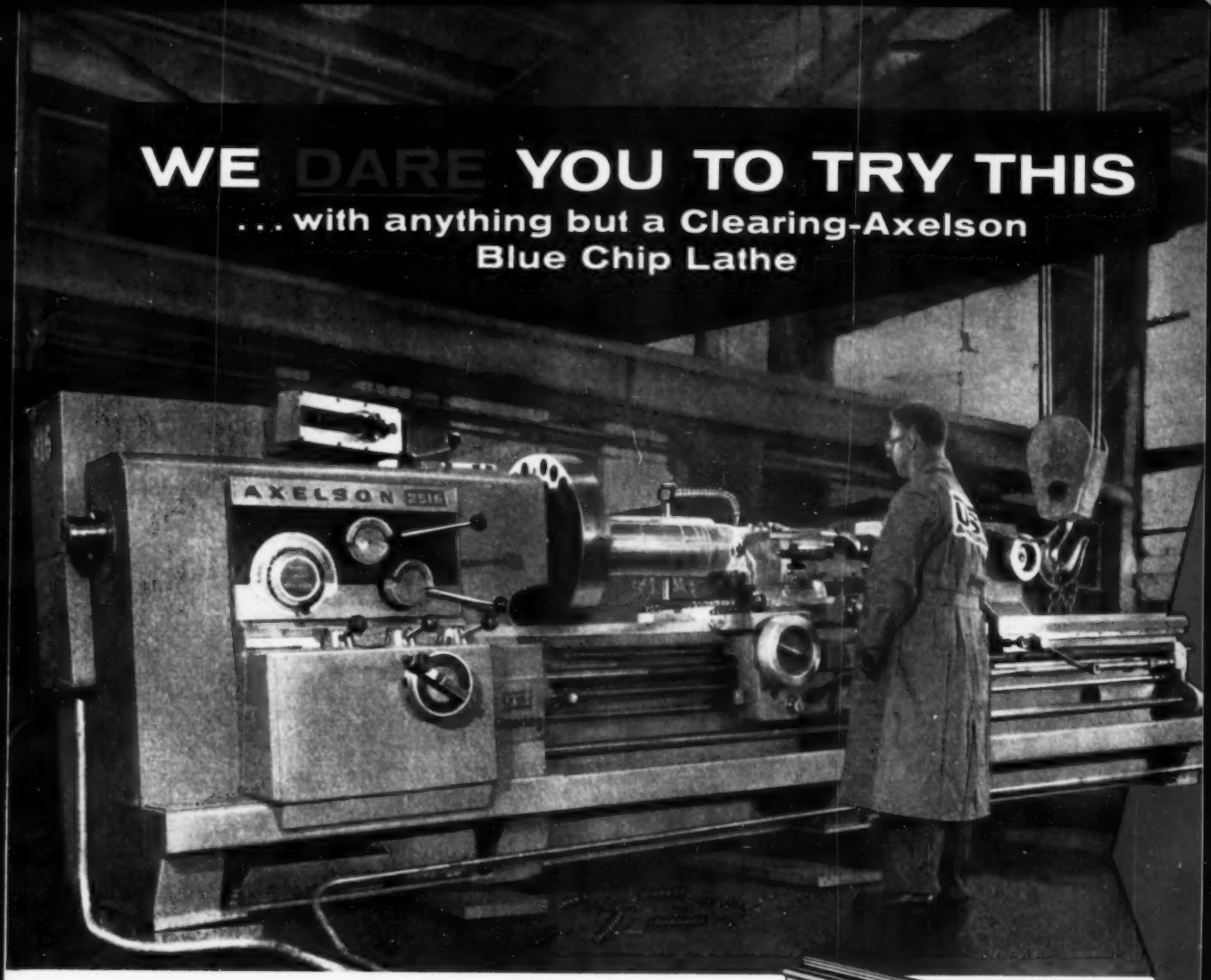
Ano-Coil, color anodized aluminum strip in coil, formerly available only from West Germany, will now be manufactured domestically for the first time in a plant recently completed at Rockville, Conn, by the newly formed Ano-Coil Corp.

Developed by Metalloxyde GmbH of Cologne, and introduced in the US several years ago by Fromson Orban Co, New York, strip will be produced by a continuous anodizing and dyeing process on equipment 200 ft long, designed, engineered and built by Metalloxyde. Installation, already in operation at Rockville, is fully automatic. Color uniformity and finish are electronically con-

(continued on p 236)

WE DARE YOU TO TRY THIS

. . . with anything but a Clearing-Axelson Blue Chip Lathe



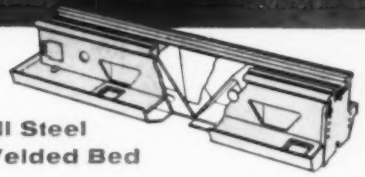
A spine smashing test—Yet we got precision results on this ¾" cut under conditions that would make any other lathe sway-backed.

Why bother to run a lathe suspended in air? Only to demonstrate the incomparable rigidity of the welded steel Clearing-Axelson Blue Chip lathe. This rigidity is absolutely permanent; it will maintain the precision of this machine through years of the most severe service.

And why, you may ask, is such enormous rigidity important?

Well, a lathe that can whistle its way through the toughest alloys yet provide vibration free operation has to be rugged. The Blue Chip lathe turns out more accurate work, faster—even when hogging off metal at a clip you would have thought impossible up to now. More horsepower permits use of latest tools—smooth, effortless operation saves you money on tooling.

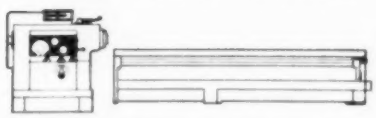
Clearing also manufactures the Clearing-Harrison lathe, presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.



All Steel Welded Bed

Stronger steel plate provides strength where it is needed. Pyramid shaped reinforcing ribs are used the entire length of the bed for high torsional rigidity.

Modular Bed Construction



Headstock and bed on Blue Chip Lathes are built as separate units. Both are all steel weldments, fully stress relieved, and both are built-to-the-floor. That's how the Blue Chip lathe can laugh at obsolescence. Need a larger bed? Order a new bed but keep your existing headstock.

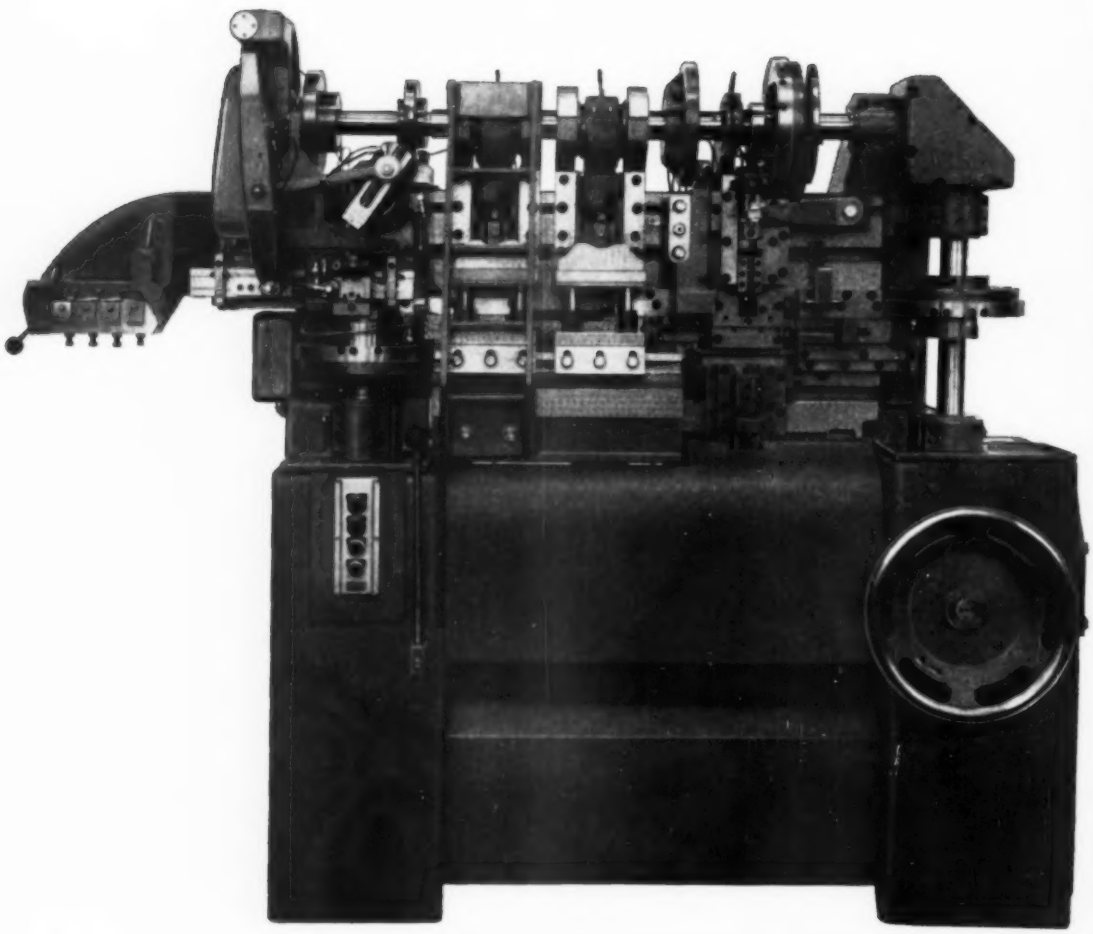
All the facts on the Blue Chip line of lathes are in this catalog. Write for your copy today.

USI Clearing

DIVISION OF U. S. INDUSTRIES, INC.

6499 W. 65th St. • Chicago 38, Illinois • Plants in: Chicago, Hamilton, Ohio, Los Angeles

ON ITS FIRST PRODUCTION JOB THIS REVOLUTIONARY MACHINE...



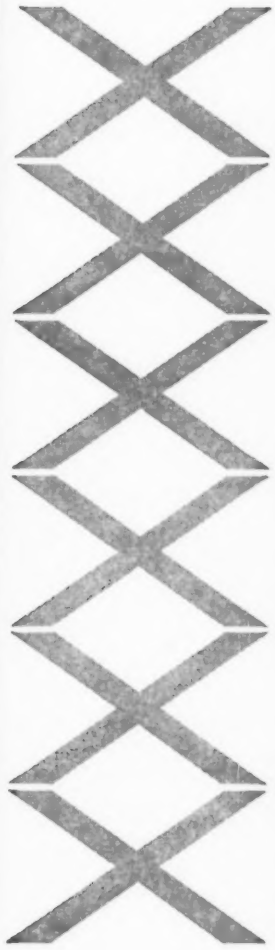
It's the sensational Torrington **Verti-Slide**, a most important **new** production tool. This amazing new vertical four-slide machine promises a genuine revolution in the **high-speed, high-precision, low-cost production** of just about everything in strip or wire that is now being produced on progressively tooled forming presses or conventional four-slide machines. Write or call today for complete technical data—or a Torrington sales engineer.

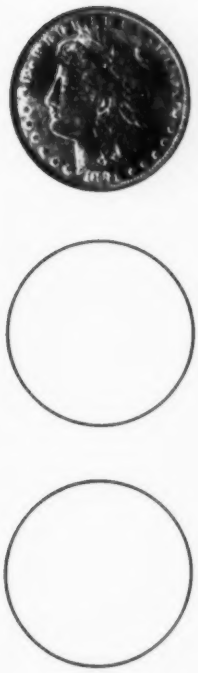
THE TORRINGTON MANUFACTURING COMPANY
TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

DID THE WORK OF SIX PROGRESSIVELY TOOLED FORMING PRESSES...

AT FOUR TIMES THE SPEED...

AND ONE-THIRD THE COST!



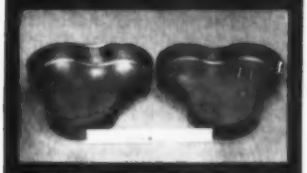


◄ CIRCLE 312 READER SERVICE CARD

CIRCLE 313 READER SERVICE CARD

LOOK WHAT YOU CAN DO WITH A BEATTY-QUICKWORK STAMPING TRIMMER

STAMPINGS before and after trimming



Trim — bead — form . . . up to 500 blank stampings per hour! The Beatty-Quickwork Stamping Trimmer is the versatile metal working machine that provides a short-cut method to speed the finishing of sheet metal stampings.

On either short runs or production jobs, this multi-purpose machine eliminates the need for expensive trimming dies — saves press time — requires minimum floor space. It trims even intricate shapes fast and accurately without burr; beads and forms in the same or separate passes.

Standard, heavy-duty and special models offer wide range of size and speeds — handle up to $\frac{3}{8}$" mild steel.

ONE OF THE BEATTY FAMILY OF METAL WORKING EQUIPMENT: Shears, Punches, Presses, Spacing Tables, Bulldozers, Stamping Trimmers

WRITE TODAY FOR COMPLETE DETAILS

BEATTY-QUICKWORK DIV.
BEATTY MACHINE & MFG. CO.
948 150th St., Hammond, Ind.

Field Report . . .

trolled throughout the coil. Because of its extremely flexible anodic oxide coating, Ano-Coil is suitable for roll forming and shallow drawing. Finishing after fabricating is completely eliminated. Sales will be handled by Fromson Orban Sales Corp, New York.

GE Gets $7 Million Ford Order

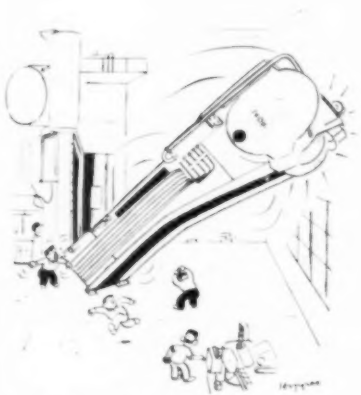
General Electric Co will furnish complete electrical systems for two Ford Motor Co metal rolling mills. Both are at Ford's Rouge plant in Dearborn, Mich, which produces sheet metal for automobile bodies. Included in the over-all control system will be the new GE automatic gage control which will use gage meters on three stands to provide accurate thickness control from entry to exit.

Rheem Acquiring Ruud

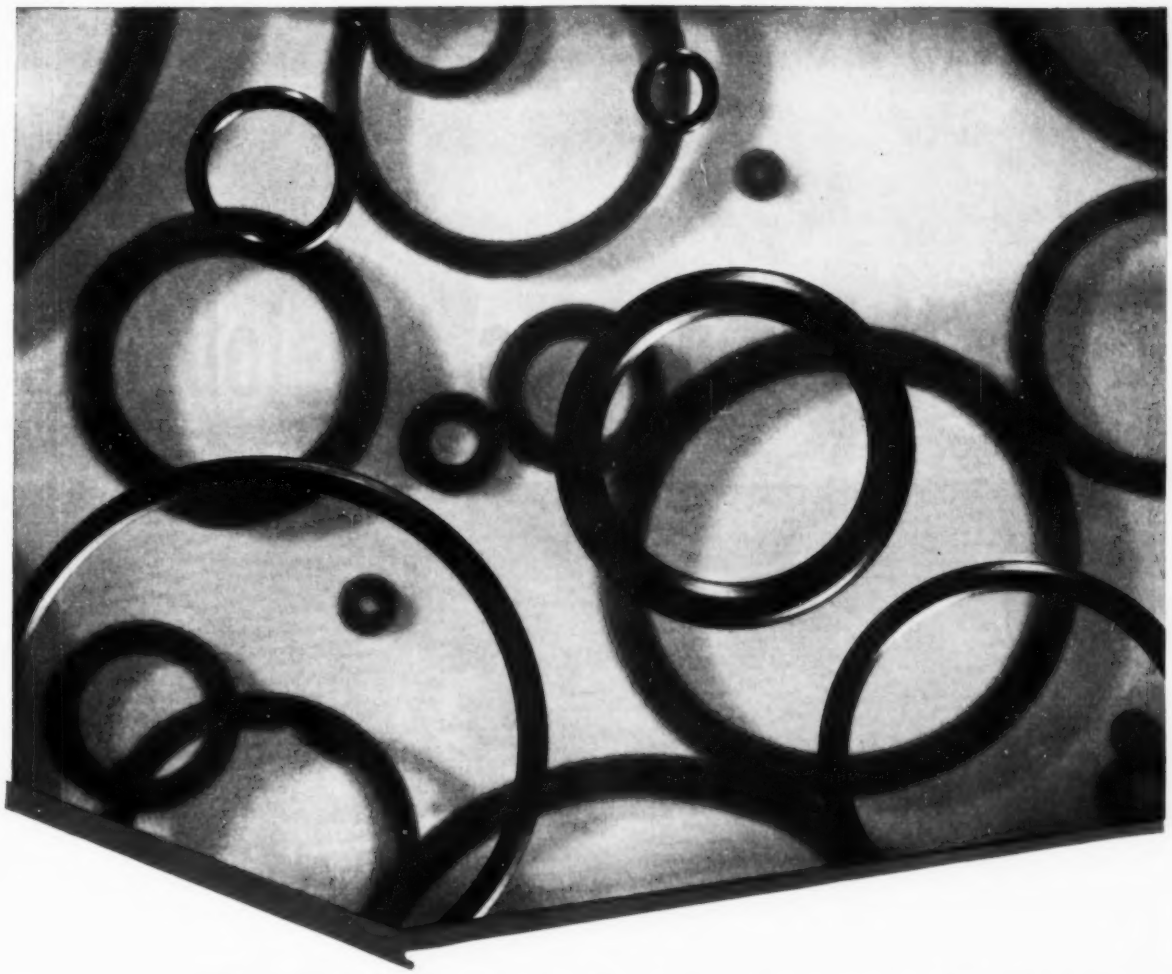
Rheem Manufacturing Co, New York, plans to acquire control of Ruud Manufacturing Co, Kalamazoo, Mich, through exchange of stock. Completion of the transaction is dependent on an 80% approval by Ruud shareholders. Ruud, with annual sales of about $10 million, produces water heaters for commercial applications.

Rambler Dealer Orders Top Production Capacity

Rambler orders at the factory for November and December exceed the company's production capacity. They're 131% greater than the same period last year and record dealer orders for December are 141% greater. American Motors reports that it has delivered 295,653 new cars since Jan 1, more than double



"I didn't mean to lean against it!"



Bearings, Inc. has "O" RINGS in all materials . . . in all sizes and quantities . . . in stock ready to ship!

Large or small "O" Ring users can get immediate delivery from the nearest Bearings, Inc. branch. "O" Rings for maintenance or for original equipment production. Call a sales engineer from Bearings, Inc. to help you solve any "O" Ring problem — Complete information on all types of "O" Rings is available. Ask for it NOW!

These Materials Available: Standard Buna-N Rubber • Viton • Teflon • Silicone Rubber • Butyl Rubber • Military Spec. Series: MIL P5516A, MIL P5315A, MIL G5510A, MIL P25732, MIL R25897, AMS 7270, AMS 7271 and AMS 7274 • Teflon and Leather Back-up Washers.

All O-Rings Available in Series 6227, 6230, 6290 and 29513.

SELECT "O" RING KITS 180 "O" Rings in Sizes 1 to 25 — All Materials — Priced from $24.50 *(Depending on Material).*

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OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
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WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
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DIXIE BEARINGS, INC.

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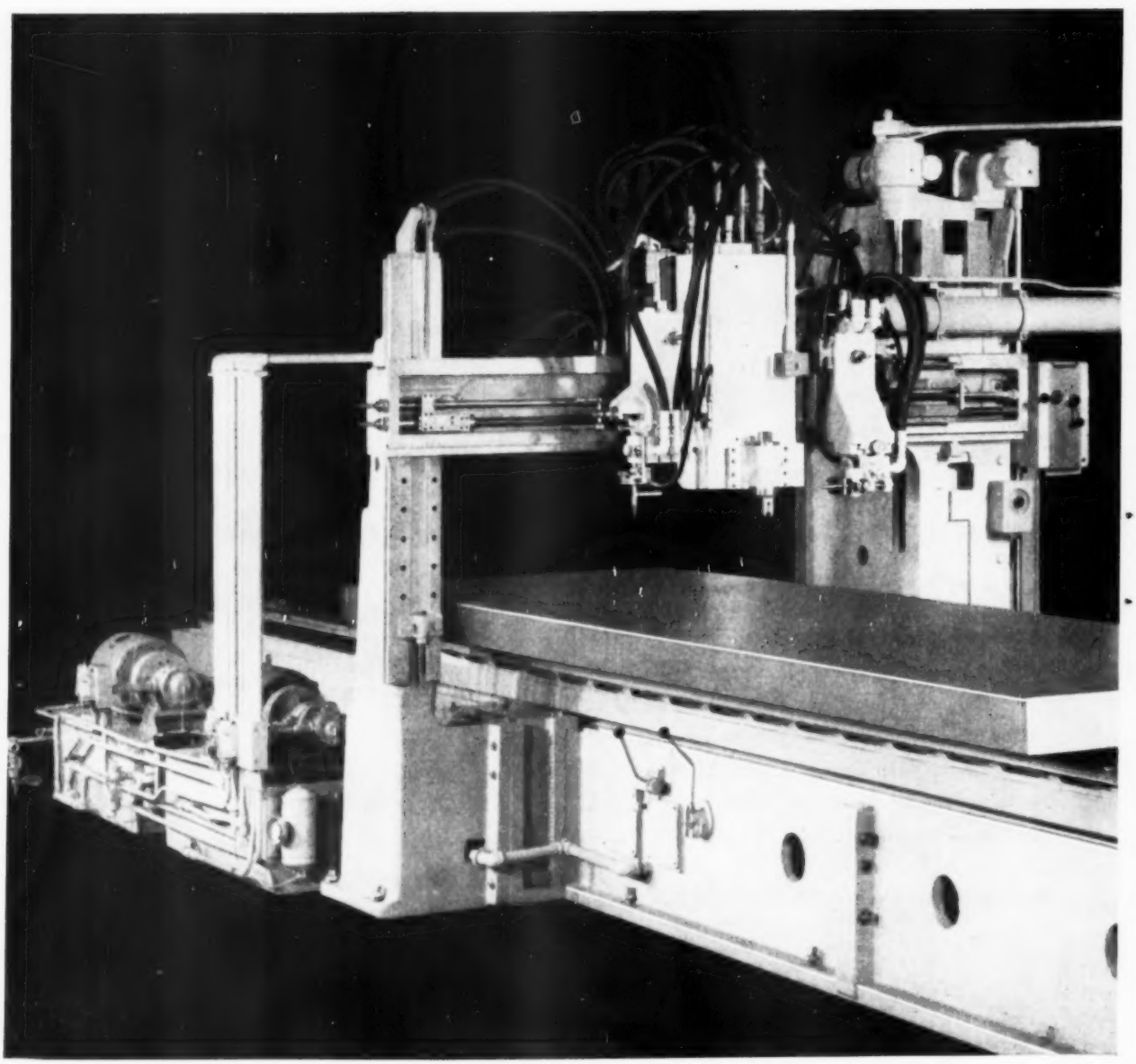
N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville
VIRGINIA: Richmond

Nothing does the job like a.

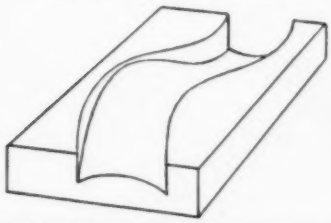


ROCKFORD

HYDRAULIC

TRACER-PLANER

MACHINES COMPLICATED CONCAVE-CONVEX AIRCRAFT PARTS IN ONE-TENTH FORMER PRODUCTION TIME



Actual savings on spar-like aircraft parts*:

- One set-up completes machining, no hand finish
- Risk of tool breakage involves only simple planer tools.
- Produces parts from rolled billets instead of expensive forgings.
- Produces parts from inexpensive masters.
- Eliminates forging dies, machining matrixes and warped parts.

*Complete production facts on request.

Nothing performs like hydraulic power...

- Infinitely adjustable feeds and speeds;
- Smooth, uniform cutting pressures for finer finish;
- Maximum metal removal per H.P. expended;
- Low Costs for machining, cutting tools and maintenance.

ROCKFORD MACHINE TOOL CO.
2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

Pioneers In The Use of Hydraulic Power for Reciprocating Machine Tools

CIRCLE 317 READER SERVICE CARD

FEEDCISION

INCREASES CENTERLESS GRINDING PRODUCTION

200%

YES

300%

With This New Automatic Infeed Grinding Attachment

Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

MODERN DEVICES

Subsidiary of

TWENTIETH CENTURY MFG. CO.

Box 429 A Libertyville, Illinois

Open Territories for Manufacturers' Representatives

Field Report . . .

the 139,332 of the similar 1958 period. Rambler is working two turns on a six-day week and is adding 1000 men at its Milwaukee and Kenosha, Wis, plants.

And, according to President George Romney, company is "carefully studying all of the possibilities of a program in the European area" in the Common Market there. It's also "studying companies available for joint programs."

NCR May Build in Ghana

National Cash Register Co is mulling over the idea of setting up an accounting machine factory in Ghana. Project depends upon Ghanaian interest in the machines; currently there are about 1200 in the country. The West African National Cash Register Ltd, established there 10 years ago, has made pretty good progress. It is mapping plans to train Ghanaians to maintain and service the machines. NCR has also set up a training institution in Lagos, Nigeria, where qualified Africans are learning how to use and maintain the machines.

Society of Carbide Engineers Sponsoring Educational Program

The New York-New Jersey chapter of SCE is contacting 4000 leading metalworking plants in their area inviting participation in an educational training program at no cost to trainees. Series, to begin the last week of January 1960 and continue monthly through June, will cover practical application of carbide fundamentals. Typical subjects: history, manufacturing, and theory of ce-

Every time I work with this stuff, I have to laugh!"

SIMONDS

INDUSTRIAL CUT GEARS

LARGE OR SMALL HEAT TREATED OR PLAIN

SIMONDS has over 60 years' experience in cutting quality industrial gears. We can supply any type of gear in cast or forged steel, gray iron, bronze, Meehanite, rawhide or bakelite in a full range of sizes adaptable to the material. Also heat-treated, case or flame hardened gears of carbon or alloy steel. Send us your requirements for quotation.

Custom GEAR CUTTING

SIMONDS' facilities can produce any type of custom gear from your blanks if you prefer. Same quality . . . same prompt service.

QUALITY GEARS FOR OVER 65 YEARS

SPUR GEARS
BEVEL GEARS
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WORMS WORM GEARS
RACKS PINIONS

Also stock carrying distributors of Ramsey Silent Chain Drives and Couplings; and industrial V-belts.

SIMONDS GEARS

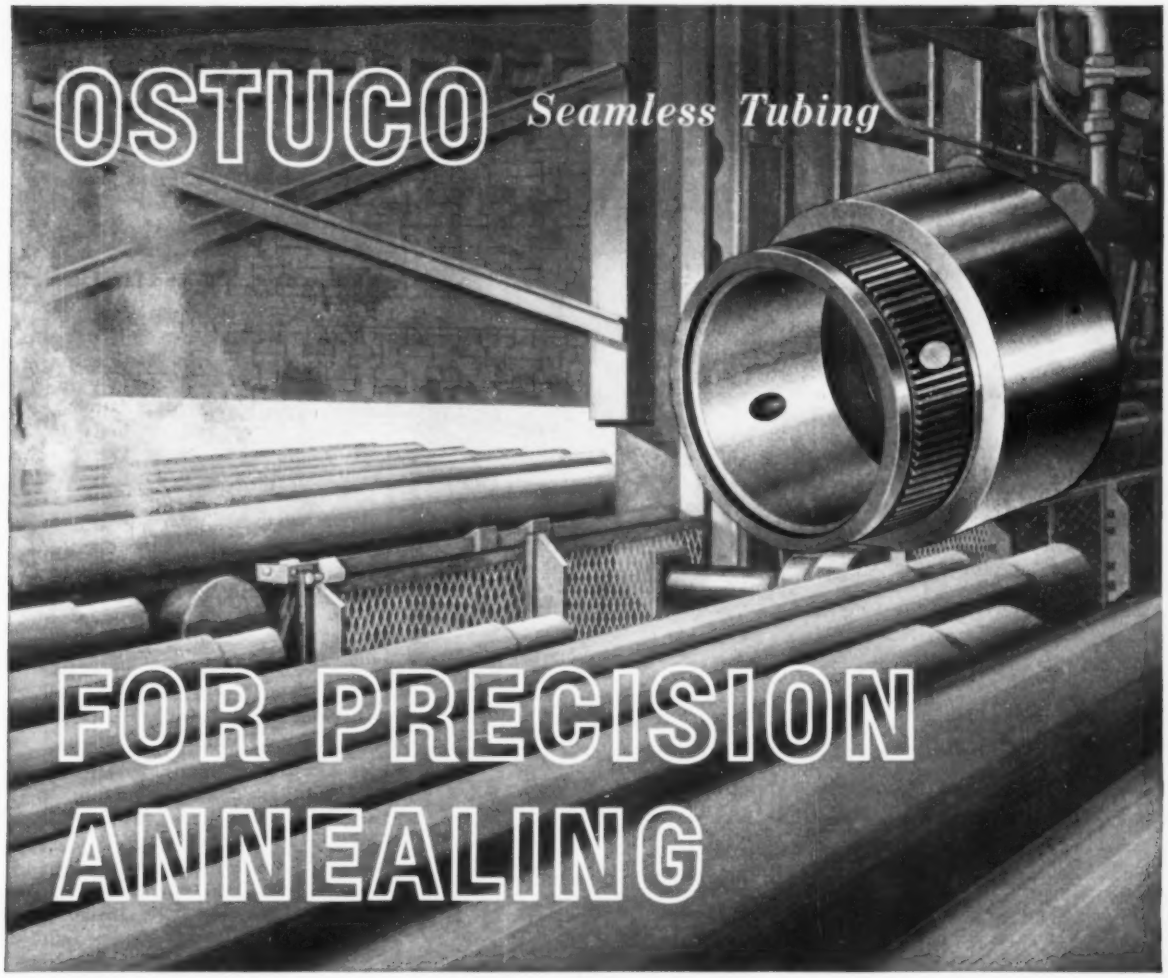
THE SIMONDS GEAR & MFG. CO.

LIBERTY at 25TH PITTSBURGH 22, PA.

CIRCLE 318 READER SERVICE CARD

CIRCLE 319 READER SERVICE CARD

Automatic Transmission Manufacturer Specifies



Annealing furnace at the Shelby mill. Ostuco tubing can be bright or soft annealed, stress relieved, normalized or heat treated.

"As a leading producer of quality transmission components, we can't leave anything to chance. Our design requirements, materials specifications and manufacturing processes are under the most stringent quality control standards. And we demand as much of our vendors.

"One sure way we have found to eliminate the unpredictable is to specify Ostuco Seamless Tubing. We know from experience we can rely on the precision annealing and unvarying quality of Ostuco tubing that slashes reject rates, helps us produce parts in quantity for profit . . ."

If you want to eliminate the unpredictable in your own plant, then it's time you called your local Ohio Seamless representative. He's listed in the Yellow Pages. Or contact the plant at *Shelby, Ohio —Birthplace of the Seamless Steel Tube Industry in America.*

AA 9604

OSTUCO TUBING

OHIO SEAMLESS TUBE DIVISION

of Copperweld Steel Company • SHELBY, OHIO

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

SALES OFFICES: Birmingham, Charlotte, Chicago (Oak Park), Cleveland, Dayton, Denver, Detroit (Huntington Woods), Houston, Los Angeles (Lynwood), Miami, Moline, New Orleans (Chalmette), New York, North Kansas City, Philadelphia (Wynnewood), Pittsburgh, Rochester, St. Louis, St. Paul, Salt Lake City, Seattle, Tulsa, Wichita CANADA: Railway & Power Engr. Corp., Ltd. EXPORT: Copperweld Steel International Company, 225 Broadway, New York 7, New York

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Automatic Machine Loading

● You can meet and beat competition by getting peak production from every machine in your shop — new *and* old. Lipe Automatic Machine Loading delivers at least 90% of the gross geared capacity of any production machine, because stock is fed continuously. Your machines cut stock — not air!

● Lipe AML Bar Feeds automatically feed stock of practically every length, shape and material, in close-tolerance feedouts. Users report production increases of 40% . . . 90% . . . and even 200% per machine, plus labor benefits that are even more important. Workers are freed from back-breaking hand-loading of stock . . . concentrate on quality and machine set-ups. For a free estimate of what Lipe AML can do for your shop, send prints or samples of typical work. Write for full information.

Stop Cutting Air and You Start Cutting Costs

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N.Y.

PIONEERS IN PNEUMATIC BAR-FEEDING

Field Report . . .

mented carbides; carbides, their properties, testing, and grade selection; tool manufacture and maintenance; stamping applications using cemented carbide dies. Each session will last about 1½ to 2 hours and consist of a lecture by a well known carbide authority, plus a question and answer period. Plans are being made for advanced carbide programs in the fall.

Barden Buys Tool and Die Plant

Barden Corp, Danbury, Conn, manufacturer of precision ball bearings, has bought the Lacey Manufacturing Co, Bridgeport tool and die fabricator. Barden has been purchasing stamped metal ball retainers from Lacey for many years. Lacey will continue to supply ball retainers and other types of precision metal stampings to its other industrial customers. Company, which will be operated as a Barden subsidiary, will remain in Bridgeport and will continue to turn out its product line which includes custom tooling and dies and stamped metal parts.

Chrysler Building in Syracuse

New Process Gear Division of Chrysler Corp is planning to put up a multi-million-dollar plant in the town of DeWitt, just east of Syracuse. The 400,000 sq-ft facility on a 125-acre tract would replace three 50-year-old NPGD buildings located in downtown Syracuse. Initial employment will be approximately 1250, about the same as current payroll at the old location.

Mack Trucks Closing NJ Plant

The 3200-worker plant operated by Mack Trucks Inc in Plainfield will be gradually closed down over an 18-month period. Company is studying locations for possible consolidation, including Allentown, Penna, where it has facilities employing 4000, and room for expansion. Company won't say what would happen to the Allentown plant if it eventually decides to consolidate somewhere else, however.

Rockwell Adding in Germany

Rockwell Manufacturing Co, Pittsburgh, is building a 150,000 sq-ft addition to its plant in Pinneberg, West Germany, for manufacture of liquid meters, valves, and woodworking power tools for the European and world markets. And sales of small

diesel and gasoline engines, the West German subsidiary's original product line, are setting records. Reasons for this are the rapidly increasing popularity of power mowers throughout West Germany and other European nations, and a big jump in motorcycle and motorbike sales for export to less developed nations.

Autos in Portugal

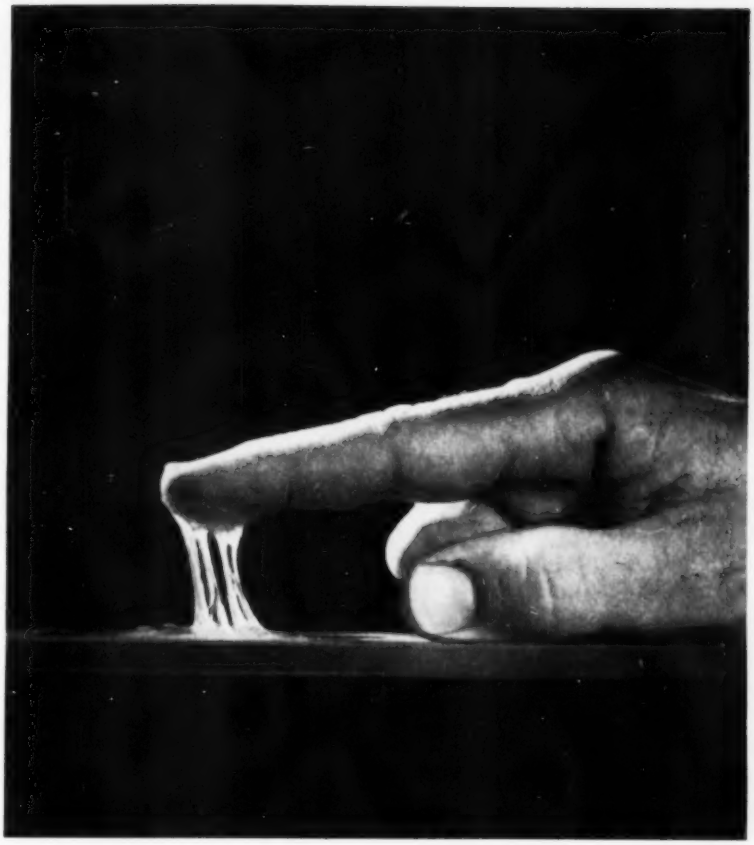
Portuguese Ministry of Economy has approved a privately-backed project for production of passenger cars, trucks, and tractors. Plan has strong backing from Italian and French automobile producers and influential business interests including the Portuguese Steel Co whose blast furnace is presently under construction near Lisbon. Plan also has its opponents, especially the automobile importers' association. Details of the project are not yet available except that the new company will be called Fabrica de Automoveis Portuguese.

Conditions: FAP must set up its corporate organization within six months, be ready to produce within two years, and eventually turn out at least two types of small economy cars. Also within six months, 60% of the materials and parts contained in the units produced must be of Portuguese origin.

Singer Gets $1 Million Navy Order

Bureau of Aeronautics contract for manufacture of AN/ASR-3 submarine detecting sets has been awarded to the Singer-Bridgeport plant, Military Products Division of the Singer Manufacturing Co. Work is scheduled to run until early 1961. Production of electronic equipment for the Navy represents the first major prime contract for the Connecticut plant. During the past several months

"Oh, here's the work order on that job you're going on—'Replace one screw on pencil sharpener.'"



What's glue got to do with the price of finishing?

Stuck? Then you'll be interested to learn that glue is but one of several bonds used to hold the cutting grains to the backing in the manufacture of coated abrasives. Varnishes and resins are also common bonding materials. The problem is to select the proper bonding material to assure maximum belt life. Jewel Brand Abrasive Engineers know, for example, that glue is commonly recommended for dry, low heat applications while resins are usually required where toughness and resistance to water, heat and high working pressures are in demand. Their ability to recommend the proper bonding material often results in substantial savings in time, labor and materials. It will pay you to put their knowledge to work for you. Write for complete details. Abrasive Products, Inc., 561 Pearl Street, South Braintree, Mass.

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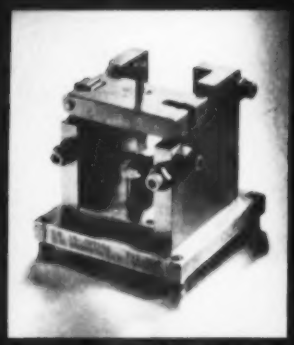
Tooling with tape...



This drill jig: $280.00

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Ask us to arrange a demonstration with **your** parts.
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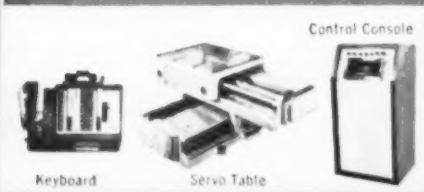
Also—movies shown at your shop or plant on request.



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A DIVISION OF GENERAL DYNAMICS
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Field Report . . .

Singer-Bridgeport has received a number of smaller contracts including production of components for the Navy Sidewinder. It's also engaged in research and development work for the armed forces and in the manufacture of other electronic and optical components for the missile and space fields.

Stokes Expands Facilities

F J Stokes Corp, producer of high-vacuum processing equipment, plastics molding equipment, and powder metal compacting presses, has started construction of a 50,000 sq-ft addition to its plant in Philadelphia. Expansion, scheduled for completion by the middle of next year, will increase the firm's manufacturing and assembly capacity by about 20%. When fully equipped, new facilities are expected to result in an increase in employment of 200, bringing the total number of workers over the 1000 mark.

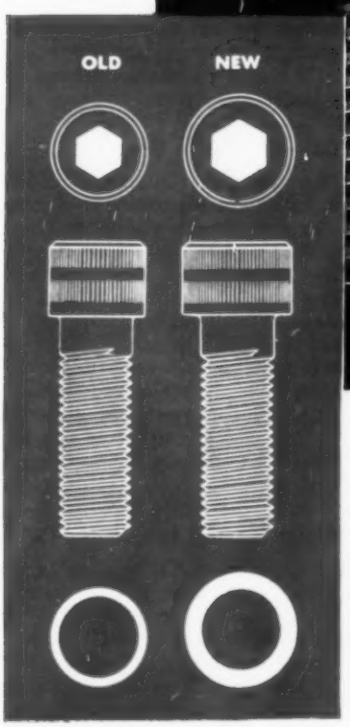
Italian Auto Production Up 15%

First half of 1959 saw a rise of 239,432 units compared with 211,209 for the same period in 1958. Figures include cars, trucks, and buses. Production of Turin's auto industries, chiefly Fiat and Lancia, jumped from 187,043 units during the first half of '58 to 215,669 for the first half of '59. Major balance of Italian automobiles is produced by Alfa Romeo of Milan.

Westinghouse Forms Association To Aid Micarta Fabricators

Seventeen major fabricators of industrial parts from high-pressure thermosetting plastic laminates will form the nucleus of a new association organized to gain from the en-

"I'm in a great humor this morning. Don't let anybody in who wants anything."



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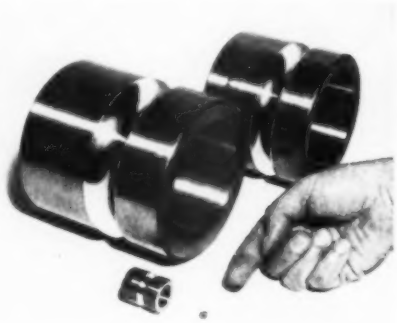
MICROHONE*

YOUR CRITICAL ANTI-FRICTION BEARING SURFACES? BECAUSE...

Bearing loads and speeds, in ~~common~~ use today, demand critical bearing surfaces that are accurate, have correct geometry and proper surface finish. Also, the process that generates these surfaces must keep production costs to a minimum.

MICROHONING INCREASES PRODUCTION

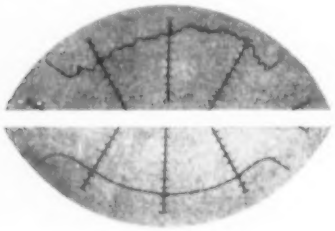
Microhoning is the first successful method for automatic processing and handling of raceway rings on multiple machines. It increases production several times over output of former methods.



Raceways of inner and outer rings for ball diameters ranging from .062" to 1.50" are currently being Microhoned.

MICROHONING IMPROVES BEARINGS

The ability of Microhoning to greatly improve the functional characteristics of critical bearing surfaces is even more significant. For instance . . . quieter-running, longer-life ball bearings are obtained because Microhoning of races assures:



Comparative Talyrond charts—each division of radial lines equals 50 millionths of an inch. Top: raceway curvature of a finished, unhoned precision bearing. Bottom: curvature of Microhoned raceway.

1 Improved concentricity between raceway and bore;

2 Removal of humps in raceway and trueing of plane of track;

3 Correct track curvature for greater contact with balls;

4 Simultaneous improvement of accuracy and surface finish.

Critical checking on precision instruments, and comparative performance studies have convinced many bearing makers and users that Microhoned bearings run smoother, quieter, and longer than those processed by any other method.

*Registered U.S. Pat. Off.

For further information, write to:

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Field Report . . .

gineering, research, manufacturing, and marketing counsel of Westinghouse Electric Corp's Micarta Division. First meeting of the new organization, the Micarta Fabricators' Association, will be held early in 1960 at the Westinghouse Micarta plant in Hampton, SC.

First of several major projects that Westinghouse will direct for the group will be an intensive training program covering fabricating methods, product engineering, and manufacturing operations. Purpose of the program will be to aid fabricators in reducing costs and improving quality on the thousands of items they make from Micarta materials for industrial applications. Products range in size from tiny structural components for electronic equipment to massive stern-tube rudder bearings for ocean vessels. Except for a few advanced technology items manufactured by Westinghouse at its Hampton plant, all fabricated Micarta products are made by fabricating firms.

Chrysler Tank Plant to Continue

Defense Dept has turned down Army plans which would have meant closing of the Lenape Tank Arsenal run by Chrysler Corp at Newark, Del. Reports have been circulating that tank production might be moved from Delaware to Illinois or Michigan. Delaware Senator J Allen Frear says he'll continue to urge authorities to keep the Chrysler plant in operation and to retain it as a major component of any new production program.

Dow Plastics in Greece

Dow Chemical Co, Midland, Mich, is forming a subsidiary to manufacture polystyrene plastic in Greece. Greek government has approved Dow's investment in a plant to cost in excess of a million dollars. Construction will begin as soon as a site has been selected and operations are scheduled to start early in 1961. Facility, using imported raw materials, will be the first to produce the plastic in Greece. Output is scheduled for both the Greek market and for export.

Alpha Plastics Inc . . .

. . . Livingston, NJ, extruder of rigid polyvinyl chloride, has set up a custom extrusion department to produce special rigid PVC shapes to customers' designs and also to counsel and assist them in part design.

NC Gets Big Plant

C M Hall Lamp Co, Detroit maker of automobile and airplane lighting equipment, is putting up a plant at Fayetteville. Scheduled to go into production next spring, it'll employ about 1000 workers. Company now has a branch at Clinton, NC.

Varian Associates Ups Expansion

Electronics firm's master plan for its Stanford Industrial Park (Palo Alto, Calif) location has been upped from 500,000 to 1,000,000 sq ft. Original lessee in the 350-acre park development, Varian's leasehold has been increased from 9.5 acres in 1951 to the present 65 acres.

Company plans an additional 225,000 sq ft to be added to its facilities during the coming year. Construction in 1959 included a 37,500 sq-ft addition to the instrument building and a 25,000 sq-ft addition to the tube research and development facilities. Scheduled for 1960 occupancy is the first 100,000 sq ft of a radiation division building, plus initial construction of an administration building and a cafeteria. Total Varian organization now has 2700 employees and total assets of more than $24 million. Order backlog for its combined companies is over $20 million.

Northrop's Norair Division . . .

. . . Hawthorne, Calif, has an AF order for 50 additional T-38A Talon supersonic jet trainers. Contract also provides for increases in the Talon tooling production-capability rate from 2 to 10 aircraft a month.

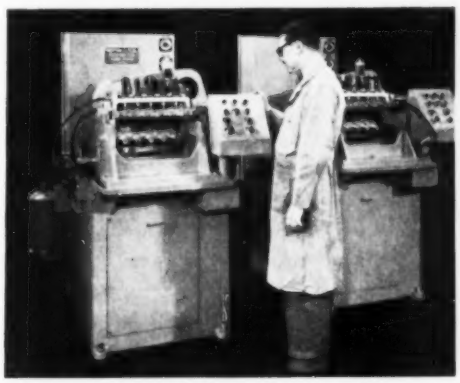
(continued on p 250)

"What's a scruple?"

HOW MICROHONING* OF CRITICAL BEARING SURFACES ASSURES QUIETER-RUNNING, LONGER-LIFE

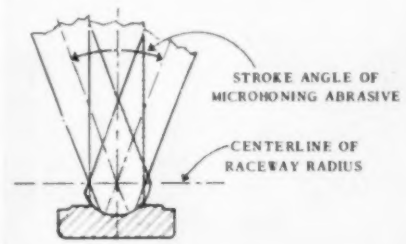
Because Microhoning is the first successful method for automatic processing and handling of anti-friction raceway rings on multiple spindle machines, production is several times higher than former methods.

In addition, here's how application of basic Microhoning principles (a combination of motions, low-velocity abrading, controlled pressure, float in tool) improve the functional characteristics of bearings: concentricity, track curvature, waviness, accuracy, surface finish.



Typical five-spindle machines for Microhoning bearing raceway. Typical production: bring high-band reading (Waveometer) of raceway waviness below one microinch, rms . . . five rings in a 20-second cycle.

Tools are positioned on an oscillating bridge so that abrasive sticks pivot about the centerline of raceway arc to generate a true radius. As rings rotate, irregularities are removed from track leaving a clean surface that is free of smeared or deformed metal. During final seconds of Microhoning cycle, speed of oscillation is automatically reduced to generate a lay pattern that runs circumferentially around the track.



Because abrasive stick pivots about centerline of raceway while rings are rotating, Microhoning improves raceway curvature, waviness, surface roughness and lay.

Microhoning technique can also be applied to raceways of cylindrical roller, tapered roller, needle, thrust and self-aligning bearings . . . also, other critical bearing surfaces.

For further information, write to:

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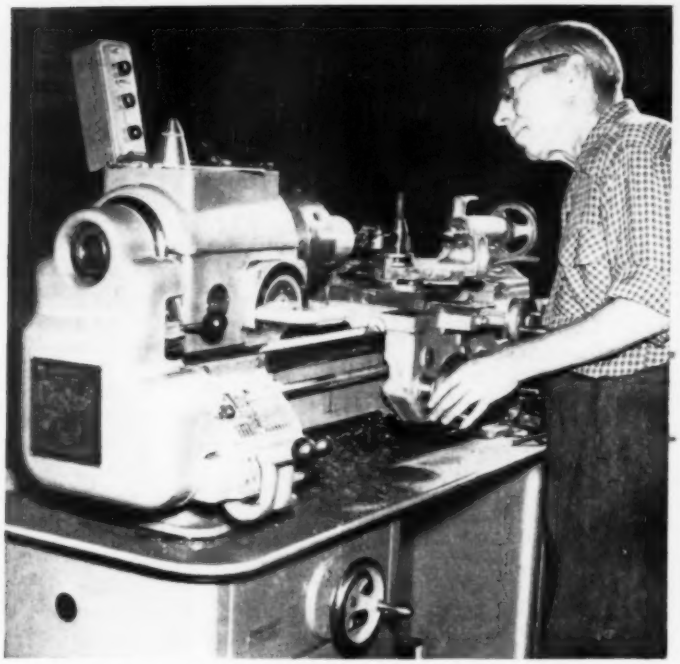
20" Drill Presses, 28 Models



11" Metal Lathes, also 10" (4' and 5' Bed)

ON ANY SIZE JOB

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17" Drill Presses, 76 Models

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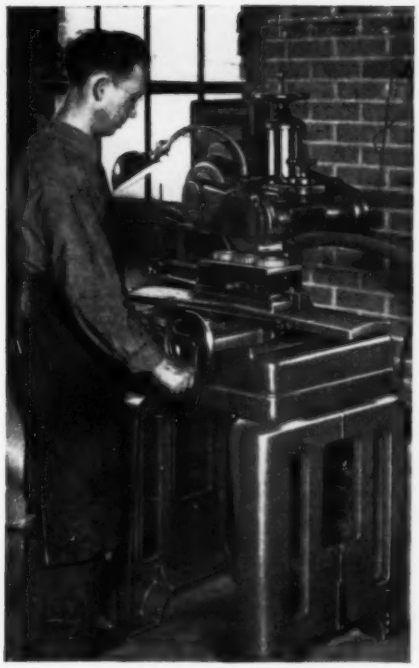
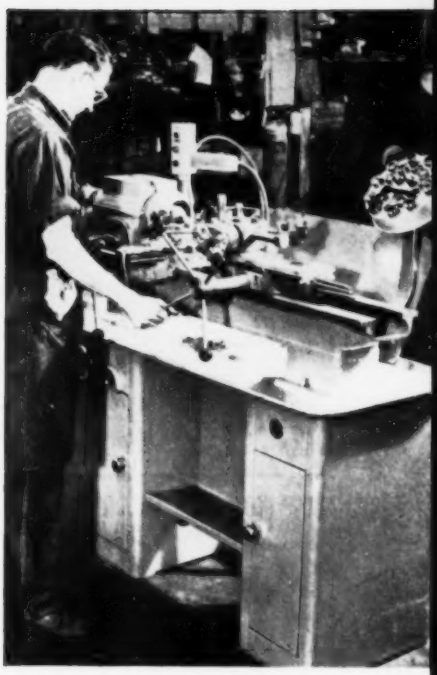


Toolmaker® Grinders, also 6" and 7"



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PAY THEIR OWN WAY

14" Drill Presses, also 14"
Super-Hi Sensitive and 15"

You'll save money three ways when you put Delta Tools to work in your shop: they cost less to buy, less to operate, and less to maintain. They're ruggedly built to withstand hard wear, yet are completely mobile—offer you precision to meet the most exacting requirements.

And versatile Delta Tools can be "teamed-up" with standard automatic control devices to provide really "lo-cost" automation. Now *any* size plant can have the benefits of automation at a *fraction* of the usual investment.

Write for FREE Delta Industrial Catalog. Rockwell Manufacturing Company, Delta Power Tool Division, 618L N. Lexington Ave., Pittsburgh 8, Pa.

See Delta Industrial Tools at your nearest Delta Dealer . . . he's listed under "TOOLS" in the Yellow Pages.

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OUR CONSTANT RESEARCH PROGRAM IS YOUR BEST GUARANTEE OF QUALITY STEELS

Field Report . . .

Space Reliability Center

Associated Testing Laboratories Inc, Caldwell, NJ, is putting up a major environmental testing facility in Orlando, Fla, for products of southern missile and electronics companies. Installation will be capable of simulating actual conditions of temperature, vibration, shock, noise, humidity, altitude, and other environmental and operating effect to which missile equipment is subjected in flight. Major reason for ATL's decision to set up the facility was a contract recently awarded to the company by Martin Co of Orlando to perform reliability and environmental tests on missile components and parts.

Impact Extrusion Co . . .

. . . Turbotville, Penna, has installed facilities for mass production of closed die impact-extruded forgings. Process employed is an economical method for producing non-ferrous forgings which have a finished surface equal to machined parts but with the full strength of forgings which can be held to consistently close tolerances.

SPS Opens Exotic Metals Lab

Standard Pressed Steel Co has opened a $100,000 pilot plant operation in Jenkintown, Penna, the first in the fastener industry to fabricate beryllium into threaded parts. Facility is a complete metalworking plant capable of producing beryllium-headed and threaded parts "to the present state of the art." Less than half the weight of titanium, and only 70% of aluminum, the material surpasses even these lightweight metals on a strength per pound basis.

Missile Subcontract to Northrop

Douglas Aircraft has selected the Nortronics Division of Northrop Corp, Santa Monica, Calif, as subcontractor for the guidance subsystem for the GAM-87A air-launched ballistic missile. This completes the team developing flight equipment for the system. Aerojet-General was recently announced as the propulsion subcontractor; General Electric's missile and space vehicle department has the re-entry body subcontract.

Daystrom Sets Up Firm in Japan

Far Eastern outlet for its electrical and electronic products has been established by Daystrom Inc through formation of a new company in con-

junction with Nichemen & Co Ltd, a Japanese trading firm. Daystrom will own a controlling interest in the concern, named Daystrom-Nichemen, KK, and based in Osaka. New company will study feasibility of licensing Japanese manufacturers to make Daystrom products. Lines to be distributed by the new firm will include Weston instruments and Heathkit radio, phonograph, and test equipment designed for assembly by the purchaser.

North American and Small Business

Three out of four firms from whom purchases were made by North American Aviation's Missile Division during fiscal year 1959 were in the small business category. Division placed purchase orders with 2645 firms; of these, 2007 (75.9%) were in the SB category. Greater percentage of the dollar value of purchases also went to these firms—a total of $16,215,803, nearly 53% of the $30,652,453 over-all.

Michigan Abrasive Forms Subsidiary

Michigan Abrasive Co of Detroit has established a subsidiary, Michigan Abrasive Co of Canada Ltd, in Kingsville, Ont. Canadian company will handle the firm's Red Coat brand coated abrasives and will be able to supply the full line of belts, disks, rolls, and sheets.

Martin Co's Orlando, Fla . . .

. . . installation has a $5 million contract for continued research and development work on the GAM-83B, an air-to-surface guided missile.

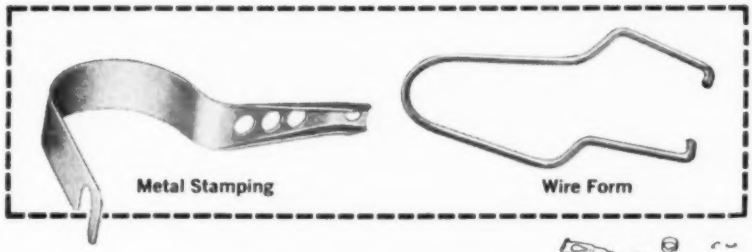
(continued on p 254)

"Sure I'll work Saturday and Sunday—I'll need the money when I start paying alimony."

4 reasons why

Nilson Automatic 4-Slides are "Universal" Forming Machines

1. **Form Wire or Ribbon Metal Stock**
2. **Accommodate Long or Short Pieces**
3. **Job Versatility through Quick-Change Cams**
4. **Combine Stamping & Forming in 1 Machine**



Every Nilson Automatic 4-Slide is truly a "universal" forming machine, a machine designed to produce either wire forms or metal stampings at high production rates.

Open construction provides easy access to all tooling . . . permits rapid changeover from one stock to the other. And longer feeds, longer slide strokes give a Nilson the built-in ability to handle a wide range of work sizes — without special attachments or accessories.

For real efficiency in your pressroom, just pick the capacity you need from Nilson's 17 models of 4-slides! One of these versatile machines will make your stamping and forming operations faster, easier . . . and more profitable.

SIZE RANGES:
Wire up to ½" diameter
Ribbon stock to 3½" wide
Feeds up to 32"

5 TO 75 TON PRESS SECTIONS

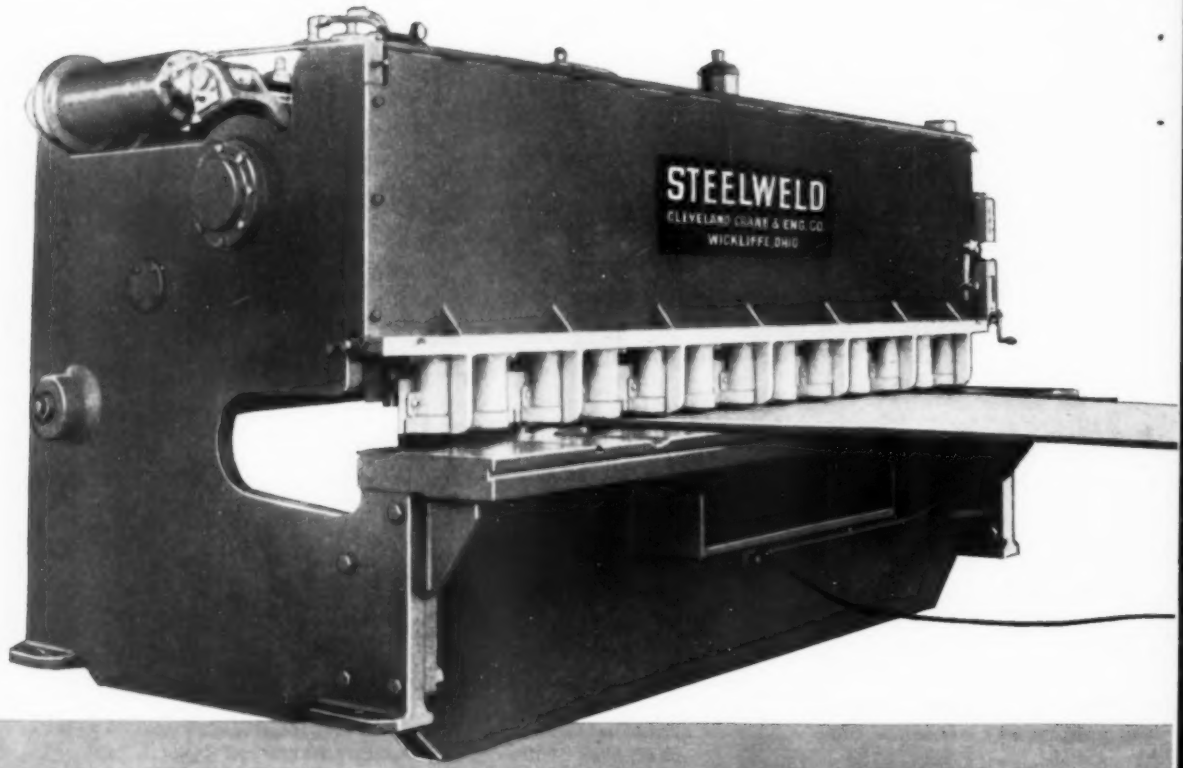
Write today for the Nilson General Catalog on Automatic 4-Slide Equipment

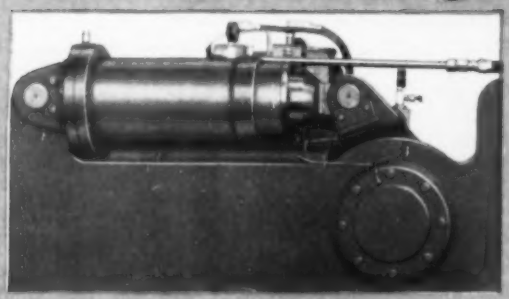
NILSON
THE A. H. NILSON MACHINE CO.
601 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

Introducing a new line of

STEELWELD Pivoted-Blade



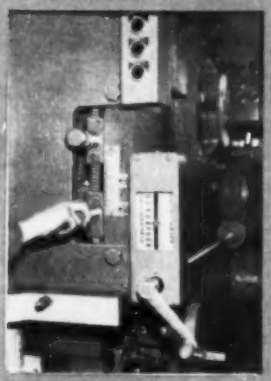


RUGGED—SIMPLIFIED HYDRAULIC DRIVE

The drive is simplified and efficient. Only one hydraulic cylinder is used, as compared to two on other machines. Hydraulic components, therefore, are reduced by one-half. No special circuit is required to keep the blade level. This is taken care of by the mechanical linkage.

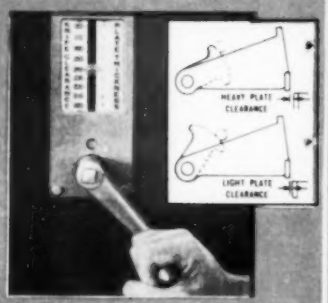
2nd SPEED FOR LIGHT CUTTING—100% FASTER

The single cylinder design provides an important bonus advantage: A second, higher speed for lighter thicknesses. Material up to and including 65% of the rated thickness is cut at double the downstroke full-load speed. The hydraulic circuit automatically changes to a slow speed full-load capacity when required.



CUTTING STROKE QUICKLY ADJUSTED

Both the upper and lower limits of blade travel can be adjusted to suit the work. With the same adjustment, the shear can be changed easily from squaring to slitting operation, or to intermediate position for notching.



FAST KNIFE CLEARANCE ADJUSTMENT ASSURES BEST CUTS

Knife clearance can be adjusted to suit different plate thicknesses. This is quickly done by turning a hand crank at front of the machine. This causes the upper knife to move toward or away from the stationary knife, as indicated in sketches. The scale shows plate thickness that may be cut for any knife setting.

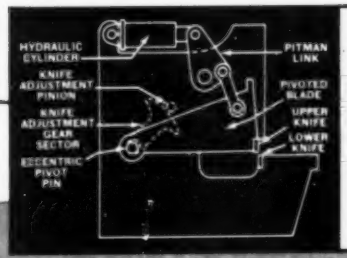
STEELWELD MACHINERY DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 1460 E. 282 ST. • WICKLIFFE, OHIO

HYDRAULIC SHEARS

Offer a combination of features found in no other shear!

COMPLETE RANGE OF SIZES FOR CUTTING PLATE WIDTHS TO 30 FEET

. . . AND THICKNESSES TO 2 INCHES



PIVOTED-BLADE DESIGN

A pivoted-blade cutting principle is used. It overcomes certain handicaps of guillotine type shears. There are no slides and guides to wear out of true and cause inaccuracies. The upper blade operates on two heavy pins secured to the end housings and travels in a circular path.

The Steelweld line of Hydraulic Shears is the newest in the Steelweld Machinery Division's fast growing family of metal forming and cutting machinery.

Entirely different from all other shears now on the market, the new machines have a machinery design that is unique and outstanding. They are replete with features that make metal cutting faster, easier and extremely accurate. Construction is heavy and of highest quality to provide long trouble-free service with minimum maintenance.

The hydraulic machines supplement the fine line of Steelweld mechanical shears, thereby making it possible to offer without partiality the most suitable machine for the work contemplated.

Write for free copy of catalog No. 2030

STEELWELD

PIVOTED BLADE

Mechanical and Hydraulic **SHEARS**

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

and many more

IMPORTANT ADVANTAGES

NO OVERLOAD DAMAGE—Steelweld Hydraulic Shears have uniform overload protection through the entire working stroke.

LOW FIXED RAKE ANGLE—Minimizes twist, camber and bow in cut pieces. Extra heavy power drive eliminates need of adjustable rake angle.

VARIOUS CONTROL CYCLES—Inching control, safety stroke, single stroke repeat, and single stroke non-repeat are provided on all standard machines.

SAFETY-TYPE FOOT SWITCH—Reduces fatigue and speeds operation. Can be moved around to most convenient location.

QUIET HYDRAULIC HOLD-DOWNS—Positive in operation with adjustable pressure to suit work. Heavily protected from damage.

EXTRA DEEP THROAT—24 inches standard. 36 inch throat depth available as extra for some sizes.

SMOOTH WORKING BACK GAUGE—Sturdily built for long accurate, trouble-free service. Ball bearings throughout. Easily operated with hand crank. Motor drive available.

KNIVES EASILY REPLACED AND SET—One man can turn or completely replace knives and make all adjustments quickly from front of machine.

CONVENIENT POWER PACKAGE—Motor, pump, oil cooler, valves, etc., mounted on oil tank and readily accessible for maintenance. May be removed as a unit from machine.

HYDRAULIC VALVES ON COMMON SUBPLATE—Eliminates considerable piping, fittings and bends. Provides an efficient, tighter, hydraulic system. Valves easily removed without disturbing piping.

3 GREAT NEW magic markers from Speedry!

SPEEDRY does it again! Three great new additions to the world's largest and most efficient line of marking, stamping, stenciling devices and inks for industry.

Speedry GIANT MAGIC MARKER

MODEL 126

U.S. Pat. No. 2616095

Type "A" Transparent inks. Instant-dry, waterproof, permanent for any surface or material. New heavy duty replaceable nib. Available in 8 colors.

Aluminum seamless body, ⅜" cube felt nib, with pocket clip. **$1.59**

Refills 89¢ Replaceable Nibs 25¢

Speedry GIANT 'OPAQUE' MAGIC MARKER

MODEL 127

Pat. Pend.

Type "BB" Opaque inks (enamel base). Instant valve action. For clean, non-porous smooth surfaces. Available in 8 colors plus white.

Aluminum seamless body, ⅜" nylon and felt nib head, with pocket clip. **$1.89** Refills 99¢

Speedry HEAVY 'OPAQUE' MAGIC MARKER

MODEL 133

Pat. Pend.

Type "DO" Heavy Opaque inks (lacquer base). Ball & Valve action in unbreakable, refillable squeeze bottle. For porous, dirty, rough, abrasive, grimy or oily surfaces. Now available white, black & yellow.

Filled ready-to-use. **$1.79**

Type "DO" inks
4 oz) $1.40 8 oz) $2.50 16 oz) $4.35

The best mark on the job is made with a Speedry product. There's at least one for every job!

proud for FREE TECHNICAL BULLETINS on specific marking, stamping, stenciling problems. Write:

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Industrial Services Division
DEPT. AM, RICHMOND HILL 18, N. Y.

Field Report . . .

Pyromet Moving, Expanding

Pyromet Co which performs brazing and heat-treating services for the aircraft, missile, nuclear energy, and electronics industries, is putting up a quarter-million-dollar permanent production plant and office at San Carlos, Calif. It'll abandon its present South San Francisco plant. New facility will include a bell furnace with 6-ft-dia working area for dry hydrogen brazing, and a company-developed high vacuum furnace, plus a metallurgical lab.

Autolite Buys Battery Firm

Electric Autolite Co, Toledo, has gone into the industrial battery market through purchase of C & D Batteries, Conshohocken, Penna. New operation will become the C & D Batteries Division of Electric Autolite.

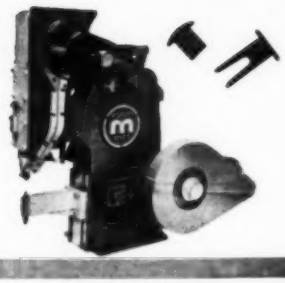
New Bearing Plant for Link-Belt

Link-Belt Co has opened a new industrial ball and roller bearing plant in Indianapolis. The 410,000 sq-ft facility located on a 70-acre site has 50% larger capacity than L-B's former plant in the city. New unit employs 775 people.

Linde Opens Chemical Plant

Linde Co, division of Union Carbide Corp, has opened its new liquid oxygen, nitrogen, and argon manufacturing plant at Pittsburg, Calif. Facility will produce 300 tons of these cryogenic chemicals daily, chiefly for the missile industry.

"Now remember, this job will determine whether or not we get the contract. Take it easy and don't let anything ruffle you."



CUT RIVET ASSEMBLY COSTS

with Milford's Complete Line of AUTOMATIC RIVETERS

Can be adapted to solve nearly every fastening and assembly problem. For the answers to assembly problems... *get in touch with Milford first!*

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNA.
ELYRIA, OHIO • AURORA, ILL. • NORWALK, CALIF.

Now—F-M Spiro-duct cooling!

Spiro-duct double-end system: In standard motor shown, air enters shaft end and discharges between feet on conduit box side of motor. Conversely, air entering free end discharges opposite conduit box. In motor with conduit box located opposite to standard position, direction of air flow is reversed in relation to drive shaft location.

Spiro-duct moves cooling air in clockwise spiral direction, through space between stator core and motor frame.

Cools entire core and winding regardless of direction of rotation!

From the research and development laboratories of Fairbanks-Morse comes Spiro-duct cooling—the most effective design available for positive cooling of Dripproof motors—available now in F-M rerated KZK motors, in frames 364U through 445U.

Two completely independent paths for cooling air are provided in the Spiro-duct double-end system. All portions of the stator core and winding are thus assured equal cooling, regardless of direction of rotation.

With completely redesigned and improved enclosure as well as ventilating system, Fairbanks-Morse offers an exceptionally cool motor with maximum protection against falling particles or dripping liquids.

For expert assistance in specifying, write Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Illinois. Fairbanks-Morse motors include all types in alternating and direct current, in ratings from ½ to 10,000 HP.

FAIRBANKS-MORSE

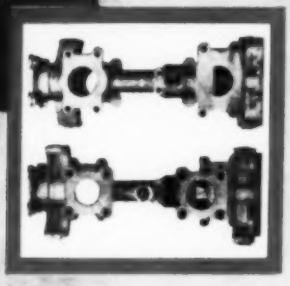
a name worth remembering when you want the BEST

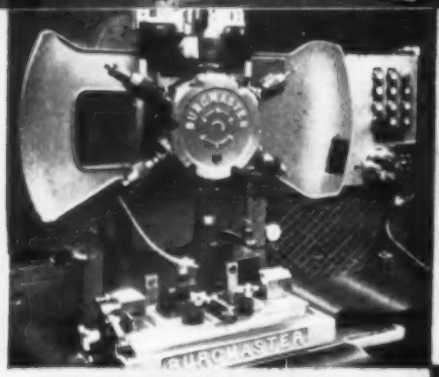
ELECTRIC MOTORS • GENERATORS • PUMPS • SCALES • DIESEL, DUAL FUEL AND GAS ENGINES • LOCOMOTIVES • COMPRESSORS • MAGNETOS • HOME WATER SYSTEMS

Stainless Steel Valve Body

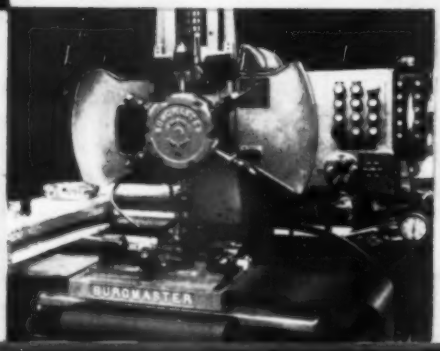
BURGMASTER *tape controlled*

#347 Stainless Steel Valve Bodies now machined on Automatic Tape Controlled Burgmasters to far better than the required ±.002" tolerances. Former time was 2.7 hours. Present time is ½ hour.





1st operation showing the simple quick clamping fixture, and tooling required to perform 32 precision drilling and c'boring operations.



2nd operation showing simple Fixture and tooling used to perform 27 drilling and reaming operations.

World's Largest Builder of Turret Drilling Machines

"O" Manual Power Index ¼" Capacity

1C Manual Power Index ⅜" Capacity

2B Manual Power Index ⅝" Capacity

2BF Flange Mounted Power Index ⅝" Capacity

2BH Automatic Hydraulic ⅝" Capacity

3BH Automatic Hydraulic 1⅛" Capacity

2BR Ram Type Radial Drill ⅝" Capacity

2BHT-3BHT Automatic Tape Controlled ⅝" and 1⅛" Capacity

Production Increased 440% With...

6 SPINDLE TURRET DRILL

(at Standard-Thomson Corp., Waltham, Mass.)

Two Burgmaster G. E. Tape Controlled 6 Spindle Turret Drilling Machines used for machining #347 Stainless Steel Valve Bodies at Standard-Thomson Corporation, Clifford Mfg. Co. Division, Waltham, Mass. have increased production 440% as compared to a multiple drilling set-up using dowel location holding fixtures. The valve jobs are now machined in 2 set-ups (one per machine) and a total of 59 operations including drilling, c'boring and reaming are automatically performed in ½ hour rather than the former time of 2.7 hours.

The machines were purchased expressly for this job although they will also be used for other work. "The repetition of controls has been perfect, and dimensions are held far beyond the required tolerance."

MAXIMUM FLEXIBLE AUTOMATION is obtained from Burgmaster 6 and 8 spindle Turret Drilling, Tapping and Boring machines because they can be quickly and economically set up to produce a large variety of parts using standard tools and simple work holding clamps.

The standard adjustable Burgmaster controls are maintained...including pre-selective spindle speeds, infinitely variable pre-selective feeds, slective rapid approach and return, skip indexing, precision depth control, and simple manual controls for set-up. The G. E. numerical system controls all machine functions, selects spindles in any sequence, automatically positions the table on two axes, clamps the table while machining operations are performed, and controls coolant. Up to 6 or 8 different operations can be performed at any command position without moving the table, or as many cycles using one tool as desired, without indexing. All operations are carried out at their most efficient rate for high finish, precision, speed, and longest tool life. As a result one man can operate two or more machines on many jobs, or by attaching two tapes together one part can be machined on one end of the table while work is being set up on the other to effect constant machine operation.

Whether your work is small lots or high production you can obtain exceptional savings and production increases with Burgmaster Tape Controlled Turret Drills. Our representatives will be glad to discuss this possibility on your work with you, at no obligation. Just call.

JOB FACTS

Machines: Two Burgmaster Tape Controlled Turret Drills.
Parts: Valve Bodies #347 Stainless Steel
Lot Size: 50
Holding Fixtures: Simple quick acting clamps
Operations: 59 — C'Drilling, Drilling, C'Boring and Reaming
Accuracy: ±.002" required
Former Time: 1st operation — 1.2 hours
2nd operation — 1.5 hours
Total: 2.7 hours
Present Time: 1st operation — .17 hours
2nd operation — .33 hours
Total: .5 hours
Savings: 2.2 hours
Production Increase: 440%
Other Advantages: Far better accuracy than required; repetition of controls has been perfect.

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CIRCLE 337 READER SERVICE CARD

Single and Double Blow

COLD HEADERS

UP TO 350 PCS. PER MIN.

Model DKP—Single Blow, with opened covers

These famous German machines feature:

- ★ CAPACITIES—3/16" to 1" dia. wire stock: Short Stroke—1" to 4-15/16" shaft length; Long Stroke—1¾" to 8"
- ★ Fitted with solid or open dies
- ★ QUICKLY ADJUSTABLE PUNCH SHIFTING SLIDE—has double locking mechanism
- ★ WEAR PLATES ARE ADJUSTABLE nitraded steel
- ★ ONE SHOT LUBRICATING SYSTEM—to all parts of machine
- ★ Special types of Cold Headers for the production of balls, cylindrical and taper rollers and cold forged components
- ★ A complete range of auxiliary equipment such as re-heading machines, trimmers, pointers, slotters and thread rollers are available

Write or Phone CL 2-7081 for details!

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The BOLTMASTER Co.

Exclusive importers of German Craftsman Peltzer & Ehlers Machinery—builders of machinery for the Bolt Industry since 1888

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MEMOS

by BESS RITTER

Many "modern" mechanical improvements in regard to today's timepieces really aren't very modern: Self-winding watches, for example, actually date back to 1750, when the first one was invented. Watches that didn't need separate keys to wind them weren't popular with the public until the 1870's. Yet the first keyless watch was invented in the 1700's.

Wrist watches (which didn't become popular until the post World War I period) have a much longer history, because the first Queen Elizabeth of England wore the first wrist watch all the way back in 1571.

Even today's modern electric clock has an ancestor that dates all the way back to the 1650's—although this clock was a pretty far cry from any timepiece that operates by electricity today. It was invented by a man named Grollier and it was placed in a horizontal position. A magnet was set inside it and this was concealed underneath a flat bowl of water. A model of a turtle floated in the water and told the time while it did so because it was pulled around the edge of the bowl by the magnet. The hour numerals were marked on the edge of the bowl. It isn't clear, however, as to how the magnet itself was made to move.

There is also positive evidence that our ultra modern electric clock which awakens the sleeper and "lights a lamp for you at any hour you please" isn't ultra modern either, because a scientific journal of the 1850's reports such a clock as having recently been patented by the United States patent office.

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 OBI PRESSES—*Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY.* 28-page bulletin 58N illustrates and describes redesigned line of Series A inclinable presses incorporating multi-point mechanical sleeve clutch. Includes performance test data, standard and optional features, specifications, die space dimensions, strokes and shut heights.

2 HEAVY-DUTY CONTOUR MACHINES—*DoAll Co, Des Plaines, Ill.* 8-page catalog, Form 59-46, covers four new models for filing, polishing, and line grinding as well as band sawing of virtually all materials from asbestos to zinc. Throat depths are 16, 36, 26, and 60 in., all with 13 inches or more work height. Standard speed ranges for two models is 35 to 6000 fpm, for the other two, 25 to 5500 fpm. Features illustrated and described.

3 HYDRAULIC PRESS BRAKES—*Dreis & Krump Manufacturing Co, 7400 S Loomis Blvd, Chicago 36, Ill.* 12-page catalog HP-59 contains data on Chicago units available in capacities from 100 to 2000 tons. Typical installations illustrated; construction and operating features detailed; specifications given on 55 standard models.

4 DEEP-DRAW PRESSES—*Cleveland Crane & Engineering Co, 1056 E 289th St, Wickliffe, Ohio.* 8-page catalog 2029-A discusses new line of Steelweld Speed-Draw presses in capacities from 200 to 1250 tons for deep-draw work as well as standard press operations such as forming, blanking, piercing, trimming, and light embossing. Patented mechanism provides operating speed reported to be 80% over that of standard mechanical presses.

5 AUTOMATIC FORM GRINDER—*Jones & Lamson Machine Co, 160 Clinton St, Springfield, Vt.* 4-page bulletin illustrates and describes features of Model E-2 for high-production, precision plunge grinding on shaft work up to 31 in. in length, also adaptable for other types of between-centers work, as well as chucking work and jobs requiring external, shoe-type support. Specifications detailed.

6 MULTIPLE-SPINDLE BORING, DRILLING, AND TAPPING MACHINES—*Sundstrand Machine Tool, Division of Sundstrand Corp, Belvidere, Ill.* Illustrated brochure, Form D5-1, provides information on precision units for producing large numbers of holes on relatively complex parts. Two models are available

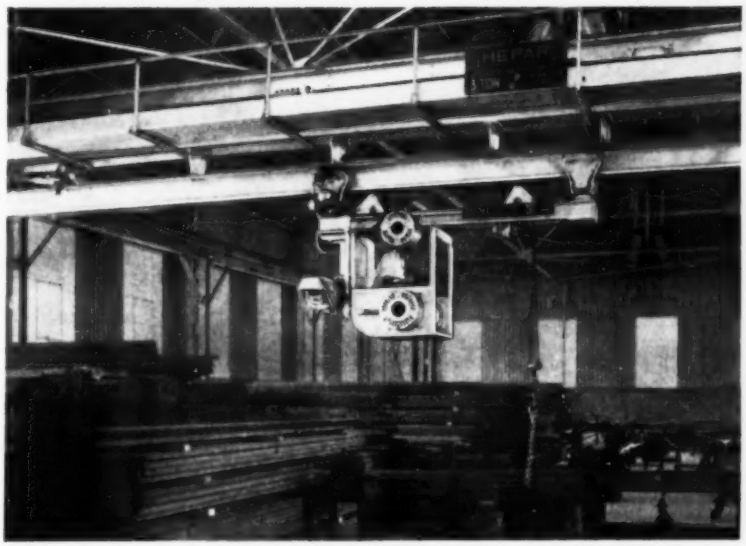
"Okay, okay! I'll clean up that slippery oil!"

SHEPARD NILES

MONORAIL HOIST

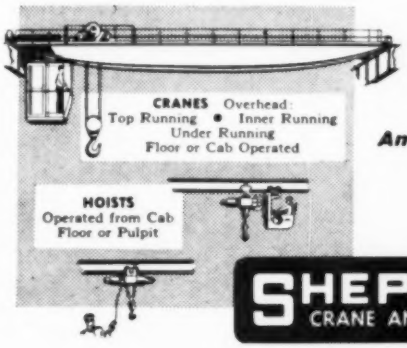
MORE ROOM

. . . for production and storage



Why move materials around men, materials and machines? Use the direct route — smoothly and safely — through air. Shepard Niles Monorail Hoists and Transfer Cranes put load handling overhead . . . eliminate costly ground level handling. Use the space saved for production and storage.

Rugged Shepard Niles hoists are available for constant or intermittent service. Choose from light, medium or heavy duty hoists equipped with cab or floor controls. Offered in fast, medium or slow speeds. Send for Monorail Ho'st bulletin today . . . or ask that a Shepard Niles representative call — there's NO OBLIGATION.



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the most inherently accurate inclinables you can buy—and so the most logical for mechanized or automated operations.

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V & O Presses and Feeds

EMHART

Free Literature

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with either an 18 x 36-in. head or a 9 x 14. Machines are designed primarily for work with non-ferrous metal parts. Includes typical performance data, specifications and dimensions.

7 WHEEL FORMING ATTACHMENT — *Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 4-page circular 631 illustrates and describes Diaform Model 5 for permanent mounting on the spindle housing of a toolroom surface grinding machine. Attachment is supplied in two sizes, Model 5-1 for grinders of approx 6 x 18-in. table working surface will form-true wheels up to 10 in. dia x 1 in. face; Model 5-2 for 8 x 24-in. grinders will process wheels up to 10 x 2 in.

8 MULTIPRESS—*Denison Engineering Division, American Brake Shoe Co, 1160 Dublin Rd, Columbus, Ohio.* 4-page illustrated bulletin 195-B gives general data on the entire line including the new R, S, and T series available in a variety of models with capacities of from 1 to 12 tons. These bench type presses conform to JIC specifications. Standard accessories described.

9 VERTICAL CUTOFF SAW—*National Copper & Smelting Co, 1862 E 123rd St, Cleveland 6, Ohio.* Illustrated Form L-625A provides information on high-speed unit adaptable for use with any type of light or heavy wall tubing, solids, or varied shapes. Cutting rate is said to be at least 10 times greater than that of regular high-speed cutoff machines; from 100,000 pieces per hr for 3/16-in.-dia tubing to 25,000 pph for 1-in. tubing.

TOOLS AND ACCESSORIES

10 CARBIDE BURS—*Thomas C Wilson Inc, 22-11 44th Ave, Long Island City 1, NY.* 12-page catalog CB-59 covers complete line of solid carbide burs for use with power hand tools and flexible shaft machines for cutting metals, plastics, and other materials. Pictures and describes 14 models each available in three or four shank diameters, with coarse, standard, or fine fluting in plain, chip breaker, or diamond cut. Includes selection and application information, and tables of sizes and prices.

11 SPLINED MILLING CUTTERS AND ARBORS—*Pratt & Whitney Co, Charter Oak Blvd, West Hartford 1, Conn.* 4-page circular 630 contains information on units for heavy-duty performance

"Oh, he's not so bad . . . just get him to talk about his bad stomach and he'll help you while away a whole afternoon."

NOW . . . A COMPLETE LINE OF SOLID
KENNAMETAL* END MILLS
stocked for immediate delivery

Now, Kennametal Inc. offers you a complete line of solid, precision-ground end mills of the same consistently high quality tungsten carbide used for years in other types of Kennametal cutting edges for the metalworking industry.

For every job requirement. Stocked in fifteen different styles, new Kennametal End Mills are available in diameters from 1/16" to 3/4" . . . a size and style to match your milling requirements.

For better finish. Kennametal has an extremely high YME . . . up to 94 million psi . . . three times that of hardest steel. High hardness, plus one-piece construction, provides maximum rigidity for smooth, even finish to meet high precision requirements.

For longer life. Kennametal End Mills are all-carbide . . . eliminate brazing failure, and provide maximum resistance to heat and abrasion.

New 12-page Catalog now available. Ask your Kennametal Representative or write Kennametal Inc., Latrobe, Pa.

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metalworking news

PUNCH LIFE INCREASED FROM 2,000 to 25,000 HOLES IN STEEL PLATE

These punches (11/16") were used to punch 25000 holes in ½", 1020 cold rolled steel plate. Without MOLYKOTE Lubricants a maximum life of only 2000 holes could be obtained.

A West Coast manufacturer was experiencing low punch life with the best conventional lubricants. Their multiple punching operation consisted of cold shearing 50 holes simultaneously in a single steel plate. A maximum life of 2,000 holes per punch was obtained with ordinary lubricants.

Then, MOLYKOTE Type G was applied to the punch occasionally. The result: punch life was increased from 2,000 to 25,000 holes which afforded substantial savings.

When writing, refer to Item 508

"A LITTLE BOTTLE FOR A BIG JOB"

- For Extending Die Life.
- For Preventing Metal Pickup.

Try it . . . Order a 10 ounce container of MOLYKOTE Type Z TODAY!

When writing, refer to Item 507

MOLYKOTE CANNOT BE SQUEEZED OUT REGARDLESS OF PRESSURES; EXCELS AS COLD-FORMING LUBRICANT IN METALWORKING

Distortion, Stick-Slip and Fretting Eliminated • Mounting Loads Reduced • Chatter and Noise Avoided • Allows Easier Disassembl

In metal forming the most difficult problem to overcome is scuffing from metal pickup on the dies. Direct contact of bare surfaces of a piece undergoing formation with the die often results in galling, scuffing, etc. If the surfaces can be separated by a lubricant of sufficient film strength, metal pickup does not occur.

Before new dies are used, burnish them with MOLYKOTE Type Z. If the lubricant you are now using does not have sufficient film strength and galling does occur, use MOLYKOTE on your dies.

The automobile industry which forms and fabricates vast tonnages of various metals, uses MOLYKOTE Type Z extensively.

When writing, refer to Item 505

Applying MOLYKOTE Lubricant to feed stock at the Bassick Company, Bridgeport, Conn., in a forming operation.

DAMAGE DUE TO IMPROPER MACHINERY "WEAR-IN" CAN BE ELIMINATED WITH NEW COMPOUND

Wear-in damage is often serious enough to require costly reconditioning of new equipment and if the damage is not repaired, it will interfere with and reduce the useful service life of expensive machinery. During this critical wear-in period, damage due to galling, scoring, tearing, scratching, excessive abrasion and seizing is an inherent hazard. MOLYKOTE WEAR-IN COMPOUND is the most effective lubricant yet developed to combat this damage.

In seven different ways, MOLYKOTE WEAR-IN COMPOUND saves you time and money:

1. **Shortens "wear-in" period without use of abrasives.**
2. **Reduces galling, seizing and excessive wear during the critical "wear-in" period in new or rebuilt machinery and after the installation of replacement parts.**
3. **Offers the best safeguard against costly reconditioning work and shipping delays due to the "breaking-in" of new machinery.**
4. **Eliminates "stick-slip" behavior and resists galling and seizing at bearing pressures far beyond the yield point of any metal.**
5. **Specifically designed for "wear-in" use. MoS_2 particles make intimate contact with bearing surfaces. Will not scrape off.**
6. **Need not be burnished into surface. Brush or wipe on a thin coating.**
7. **Inexpensive . . . a little goes a long way.**

When writing, refer to Item 506

Address your letter to The Alpha-Molykote Corp., 65 Harvard Ave., Stamford, Conn.
Phone: FIreside 8-3724.

SEE OUR CATALOG IN SWEET'S

THE ALPHA-MOLYKOTE CORP.
Stamford, Connecticut
Please send me details on

Item 505 ☐ Item 506 ☐ Item 507 ☐ Item 508 ☐

Name .....
Company .....
Address .....
City .....
State .....

THE ALPHA-MOLYKOTE CORPORATION

BREAKING LUBRICATION BARRIERS

. . . THROUGH RESEARCH

"Get rid of that DUST!"

"The boss was sore and I was on the spot.

"He shoved the report from the efficiency engineer at me. I read it: 'Yearly loss due to machine wear, misalignment and down time . . . $3,000. Major cause . . . abrasive dust.'

"The boss pointed his finger at me, 'Get rid of that dust and get rid of it fast!' "

Now, it was my problem, and I was on the spot.

"First thing I did was to check into a central dust collecting system. But the lowest bid I could get was $8,000. Too much.

"Then I came across a Torit ad, offering economical portable dust collectors.

"Two days after my call Torit engineers showed me how in only one week they could install a portable, unitized Torit Dust Collector at each of our eight grinders, trapping dust right at its source—cleaning the air throughout the entire plant.

"Total cost? Only $2400.00. That's a $5,600.00 saving over the lowest priced central system.

"You guessed it—we installed the eight Torit Collectors."

Torit solved my problem

"This year when we received our report it read: 'Loss due to machine wear, misalignment and down time... $340.00.' A saving of $2,660.

"This time the boss was all smiles. He slapped me on the back, 'Charlie, you did a fine job getting rid of that dust. Frankly, I didn't think it could be done with such a small investment.'

"Now there's a pretty nice fellow to work for.

"If you've got a dust problem, or are about to have one, write the Torit people. They've manufactured and sold more dust collectors than anyone else in the U.S.A. Chances are they can help you the way they helped us."

TORIT manufacturing company

Dept. 411, 1133 Rankin St., St. Paul 16, Minn.

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that permit machining of high-strength alloys at conventional speeds and feeds. Stock removal rate is reported to be 92% to 400% greater than with conventional design. Arbors, with 50 MM taper, are made in 1, 1¼, 1½, and 2-in. diameters in standard lengths.

12 PRECISION MEASURING TOOLS AND INSTRUMENTS—*Scherr-Tumico, 200 Lafayette St, New York 12, NY.* 96-page illustrated 1959-60 guide and catalog 25 contains detailed information on Scherr measuring tools and toolroom specialties and Zeiss products. 23-page price list included.

13 AIR-HYDRAULIC BOOSTERS — *Miller Fluid Power Division, Flick-Reedy Corp, York & Thorndale Rds, Bensenville, Ill.* 24-page engineering bulletin B-200P illustrates and describes how units convert shop air into intensified (up to 10,000 psi and over) hydraulic pressures for operating hydraulic cylinders and other hydraulically operated devices. Contains pricing, mounting, and dimensional data on popular models and sizes. Information provided on when boosters should be used in place of pumps and large bore air cylinders.

14 BORING BAR HOLDERS AND CALIBRATED BORING BARS—*Globe Tools, 3384 S Robertson Blvd, Los Angeles 34, Calif.* Literature pictures and describes complete line consisting of six sizes of holders and twelve sizes of calibrated bars to fit lathes of 8 to 36-in. swing. Includes specifications and prices.

15 THERMOCOUPLE WELLS — *Minneapolis-Honeywell Regulator Co, Wayne & Windrim Avenues, Philadelphia 44, Penna.* 18-page catalog G102-1 provides complete information for selection of proper well for any application. Covers well designs and dimensions; pressure and temperature ratings; corrosion data; thermocouple assembly data; ordering and pricing information.

16 "INDUSTRIAL RADIOGRAPHY WITH RADIOISOTOPES"—*Picker X-Ray Corp, 25 S Broadway, White Plains, NY.* 12-page illustrated booklet describes equipment and methods of radiographing all kinds of industrial products. Discusses advantages peculiar to isotopes; proper selection for a particular job; and methods of making exposures. Chart shows typical exposure times required to radiograph various materials of varying thicknesses with some of the popular isotopes.

17 GE RECORDERS—*General Electric Co, Schenectady 5, NY.* 12-page bulletin GEA-6933 provides information on complete line of recording instruments

"Maybe we should have told him we're only using these carts while the regular ones are being repaired."

Completely Satisfactory in Every Way

. . . says Mr. William H. Vogt, Division Superintendent of Parts and Tool Manufacturing at Taylor Instrument Companies, Rochester, N. Y.

NEW TYPE D Hand Feed SURFACE GRINDER

is ruggedly designed for precision work.

Taylor Instrument Companies

ROCHESTER I, N.Y., U.S.A.
May 7, 1959

Mr. John C. Wilson,
Vice-President, Sales & Engineering
The Thompson Grinder Company
Springfield, Ohio

Subject: THOMPSON Type D Surface Grinder

Dear John:

We have proven the new Thompson Type D Tool Room Grinder by rigid tests in our Tool Grinding Department. We find it completely satisfactory in every way.

We find these decided advantages on the new Thompson:

1. Its ease of adjustment
2. Its ruggedness and rigidity
3. Its bedway and column protection
4. Its large vertical capacity
5. Its cross-feed movement obtained by moving the wheel head rather than using a saddle, which permits accurate grinding of slots.

Everything considered, we find, in our work, the new Thompson Type D a very superior precision machine.

Yours very truly,

William H. Vogt

William H. Vogt
Division Superintendent
Parts and Tool Manufacturing

whv:lb

With men like Mr. Vogt, who rate tool room grinders solely on their performance, Thompson's new Type D machine is winning enthusiastic approval.

Send for descriptive literature on this new Type D machine and compare the advantages it offers you in cost-cutting time-saving and trouble-free performance. Immediate delivery is available.

THE THOMPSON GRINDER CO.

SPRINGFIELD, OHIO

Relax!

It's easy to do when you let Columbus Die-Tool handle your special tooling problems.

Many leading companies all over the United States are now availing themselves of our creative engineering staff, modern plant and equipment, to design and build their special tools, jigs, fixtures and machines. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to your exacting requirements. Increase the efficiency of your operation with special tools that do the job better—faster—more economically . . . designed and made by Columbus Die-Tool.

FREE: *New brochure listing complete facilities and equipment. Write today.*

Columbus Die-Tool

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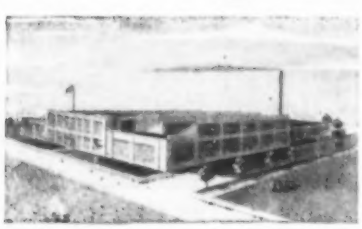

Designers and manufacturers of Jigs • Fixtures • Special Tools • Units for Machine Tools • Builders of Machine Tools Complete

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including dimensions and chart speeds, operating specifications, applications, features, and accessories. Recorders are grouped by accuracy class (¼, 1, 2, and 3%) for convenient selection. Also describes specialized recording instruments such as spectrophotometers, recording vibrometers, automatic oscillographs, self-balancing potentiometers, and speed recording systems.

HEAT TREATING AND WELDING

18 OVENS—*Despatch Oven Co, 619 S E 8th St, Minneapolis 14, Minn.* Literature available covers laboratory, pilot plant, and small batch type production ovens, and furnaces. Complete information concerning each application is provided in specialized bulletins.

19 FURNACE AND OVEN CONTROLS — *Minneapolis-Honeywell Regulator Co, Wayne and Windrim Avenues, Philadelphia 44, Penna.* 40-page bulletin B43-1C pictures and describes ElectroniK potentiometers, millivoltmeters, thermocouples, Radiamatic detectors, thermometers, flame safeguard systems, industrial controls, and final control elements.

20 WELDERS — *Harnischfeger Corp, 4400 W National Ave, Milwaukee 46, Wis.* 12-page bulletin gives condensed specifications of all P&H transformers, rectifier and rotary dc welders. Models illustrated, features described, applications discussed.

21 HEAT TREATING THERMOSTAT METALS—*Metals & Controls Division, Texas Instruments Inc, 34 Forest St, Attleboro, Mass.* 2-page bulletin TRU-9 discusses why heat treating of thermostat metal parts, even simple flat blades, is recommended; what causes stresses and the redistribution of stresses; and should design compensation be allowed for changes in shape resulting from heat treatment. Data included on heat treating temperatures, length of treatment, and quantity of parts treated per load.

22 PLASTICS PREHEATERS—*Girdler Process Equipment Division, Chemetron Corp, Louisville, Ky.* Brochure describes new line of Thermex dielectric equipment said to speed time and reduce costs for plastics preheating. Charts give power output rating for each of four new

"Cafeteria had codfish cakes!"

A New Era
in
Relay Life and Reliability

NEW

Bulletin 700, Type B-220A, AC Control Relay with 2 N.O. and 2 N.C. contacts.

NEW

Bulletin 700, Type BX-440A, AC Control Relay can be wired for normally open or normally closed contacts.

NEW ALLEN-BRADLEY BULLETIN 700 RELAYS

Improved features set new performance standards

For years, Allen-Bradley Bulletin 700 Type B and Type BX relays have been preferred for their long life and trouble free operation. The improvements in the new Bulletin 700 Type B and Type BX relays will set new performance standards wherever they are used. Naturally they use the famous A-B double break, silver alloy contacts which always remain in perfect operating condition without cleaning or filing. The cast coil cannot be damaged by the severest atmospheric conditions.

These new Allen-Bradley Bulletin 700 Type B and Type BX relays offer even greater value and greater reliability than ever before—but the price has not been changed.

- **New mechanical design gives at least 5 times greater operating life.**
- **New contact motion provides 10 times greater electrical reliability.**
- **Complete interchangeability—mounting dimensions are unchanged.**
- **New hermetically sealed plastic coil fits Bulletin 700 relays presently in use.**
- **New, stronger, movable contact crossbar—also fits old relays.**
- **New reinforced stationary contact blocks—interchangeable with previous design.**

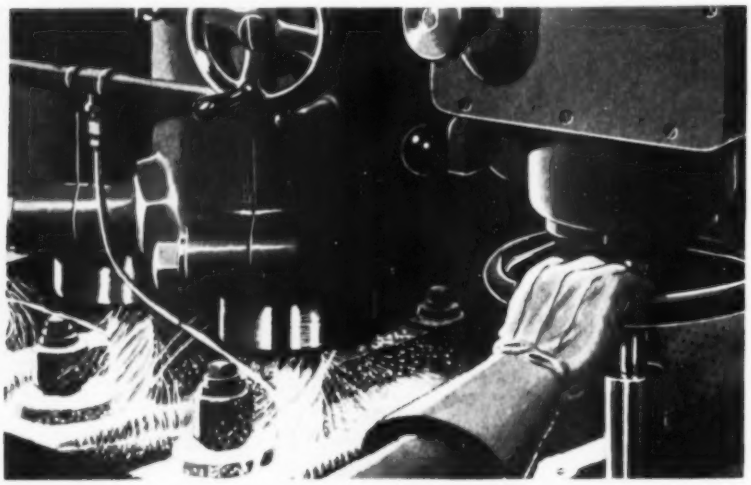
Allen-Bradley Co., 1310 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY Quality Motor Control

For top economy in oil-water lubricants

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



Oakite Formula 59 cutting solution fights rancidity . . . lasts longer

Most soluble oil cutting solutions are thrown out before they're worn out. When they turn so rancid that operators can't stand the smell, they're replaced. Understandable . . . and wasteful. But using Oakite 59 is far more economical. It *resists* rancidity, lasts far longer—especially in summer, helps protect workers from infection, cuts cost.

How well does it lubricate? Specially formulated from paraffin crude, it forms a stable, uniform emulsion in water for excellent lubrication, good cooling, corrosion protection for work and machine alike.

One of a line of Oakite lubricants for machining and forming, Oakite Formula 59 is a specialized material—as all Oakite products are. Ask the Oakite man about those designed for your operations, your products. And send for Bulletin A-9864. Oakite Products, Inc., 31E Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

50 1909-1959 SCIENCE

years' leadership in industrial cleaning

Free Literature

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models operating at 30, 50, and 70% duty cycles, and gives times required to heat various size loads of general purpose phenolic preforms to molding temperatures. Specifications provided for load-handling capacity, heating rates, power input requirements and dimensions of each model.

PLANT SERVICE EQUIPMENT

23 ANNUNCIATOR SYSTEMS—*Panalarm Division, Panellit Inc, 7401 N Hamlin Ave, Skokie, Ill.* 52-page catalog 100 C illustrates and describes function and applications of various types of equipment. Twelve systems are covered with mechanical and engineering data on components and related equipment.

24 PARTS CONVEYOR—*Rapids-Standard Co, 342 Rapistan Bldg, Grand Rapids 2, Mich.* 4-page folder provides information on the Flow Control Register. Functions include accurate unit counting, lot plus total registration, accumulation control and remote control activation. Product application features, accessories, and specifications included.

25 SLING CHAIN SAFETY—*McKay Co, 1005 Liberty Ave, Pittsburgh, Penna.* 6-part safety kit covers standard inspection and maintenance procedures for chain safety. Kit contains five folders covering different aspects. One deals with wide assortment of attachments available for sling chains, another gives specifications on McK-Alloy sling chains in sizes from ¼ through 2 in. diameter.

26 HYDRAULIC EQUIPMENT AND REFERENCE MANUAL — *Groban Supply Co, Dept P, 1139 S Wabash Ave, Chicago 5, Ill.* 60-page catalog contains special section devoted to hydraulic equipment including motors and pumps, control valves, and cylinders. Items illustrated and described with engineering specifications, technical drawings, applications.

27 HEAVY-DUTY TRUCKS — *Elwell-Parker Electric Co, 4205 St Clair Ave, Cleveland 3, Ohio.* 6-page folder covers the Elpar R-10T series available in four electric models from 6000 to 10,000-lb capacities. Discusses design of axles, motors, controls, brakes, and frames; wheelbase, turning radius, and lifting height.

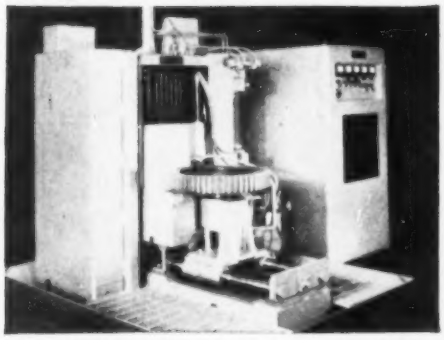
28 HYDRAULIC JET CLEANERS—*Sellers Injector Corp, 1600 Hamilton St, Philadelphia 30, Penna.* 4-page bulletin 442 describes six models for heavy-duty cleaning of walls, floors, and process equipment; three models for cleaning entire inside area of tanks.

(continued on p269)

"One day I happened to ask Miss Tweedy to get me a pack of cigarettes on her lunch time . . ."

PATTERNS FOR IMPROVED GEAR PERFORMANCE

Magnethermic Induction Scanner Heat Treats 6" to 60" Diameter Gears at... SURPRISINGLY LOW COST



Tooth by Tooth Gear Machine, a product of the Magnethermic Division

All kinds of savings with this Magnethermic method . . . low power and limited initial investment. Improved physical properties, particularly in the critical root zone, in many cases allow use of smaller gears or change-over from expensive alloy steels to plain carbon grades.

Distortion minimized with only a small part of the gear heat affected; no over-all compressive forces.

Flexibility of scanning makes inductors applicable to varying face widths, machine adaptable to many gear types, plus sprockets.

With automatic indexing, attention is confined to loading and unloading . . . cumulative positioning errors are eliminated.

These advantages have been proved in actual installations.

For estimate, quotation or engineering evaluation, send prints or outline your requirements in a letter.

Induction Heating is our ***ONLY*** *Business*

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P.O. Box 1418 • Lalor & Hancock Streets
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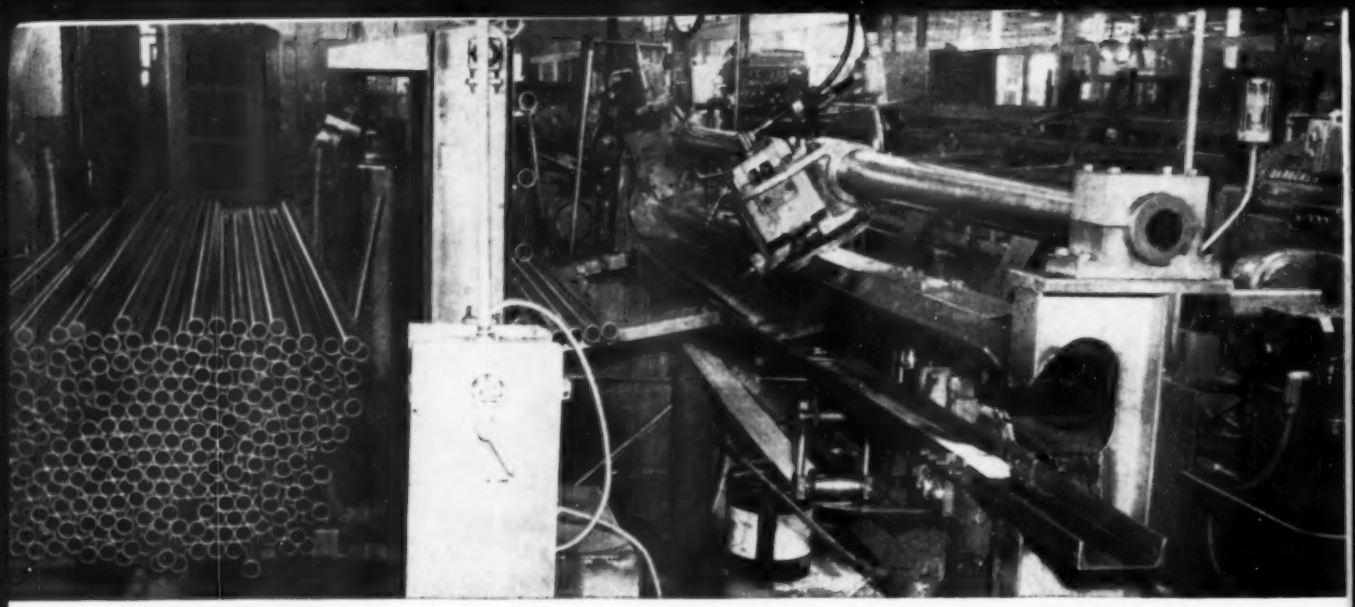
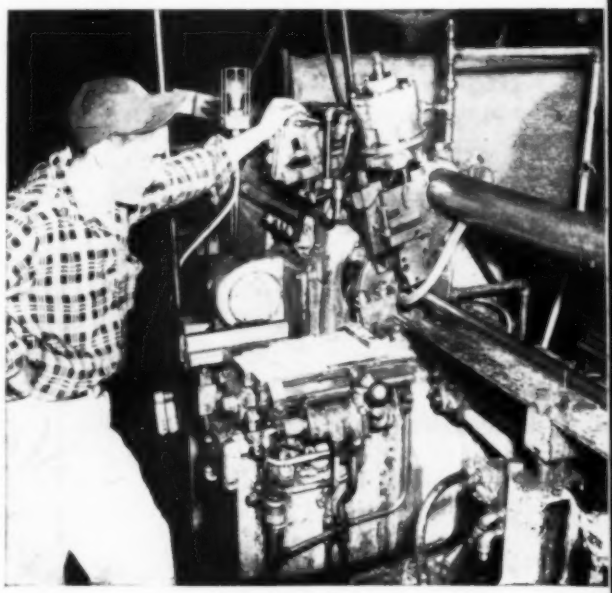


"Flexible Automation"

WITH BARDONS & OLIVER CUTTING-OFF LATHES

at Falls Steel Tube & Manufacturing Co., Newton Falls, Ohio

At Falls Steel Tube & Mfg. Co., manufacturers of exhaust pipes, tail pipes, and similar automotive tubular parts, the output of two electric weld tube mills is automatically transferred to three Bardons & Oliver loading tables. The tubing is then fed into three Bardons & Oliver Cutting-Off Lathes and automatically cut off in any required length from 6 inches to 10 feet. The cutoff lengths are automatically unloaded into tote trucks. Besides wide variance in length, tubing diameters vary from ½ to 3 inches and wall thickness from 14 to 20 gauge.



Victor Beltram, Chief Engineer, reports labor reduced by 75% and cutoff capacity increased by 50% with the Bardons & Oliver installation. Previously, cutoff operations were performed on circular sawing machines. The cutting-off lathes produce square ends and smooth finishes which have greatly facilitated secondary operations. The increased cutoff capacity has allowed greater utilization of all plant facilities. The complete Bardons & Oliver installation has paid for itself in less than three years.

If you cut off spacers, bushings, nipples, couplings, rollers, similar tubular products, or solid bar stock, we suggest you explore the profit possibility offered by these versatile machines. Bardons & Oliver manufactures a complete line of Cutting-Off Lathes ranging in collet capacity from 2 to 16 inches.

BARDONS & OLIVER

BARDONS & OLIVER, INC., 1134 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

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To order any of these bulletins, circle corresponding number inside back cover.

29 STRAPPING MACHINES—*General Strapping Corp, 100 Park Ave, New York 17, NY.* 16-page illustrated catalog provides information on models of automatic machines using both steel strapping and wire. Describes hand tools for strapping of packages or bundles. Includes weight, length, and configuration data on steel strapping of nine standard gages and numerous widths.

30 STRIPPABLE COATINGS—*Bischoff Chemical Corp, 220 Miller Rd, Hicksville, NY.* Bulletin on Thermo-Cote plastic coatings discusses protection afforded tools and small metal parts by dipping them in Thermo-Cote melt. Various compounds described include commercial grades and those that meet military specifications. Also covers N-4 compound used as a stop-off in plating to save time and labor in masking operations.

31 POWDERED PICKLING COMPOUNDS—*Frederick Gumm Chemical Co, 538 Forest St, Kearny, NJ.* 4-page technical bulletin describes advantages in variety of applications; cites a number of specific pickling problems with the compound recommended for each, together with description of product. Includes recommended working temperatures, concentrations used, and length of treatment time.

32 SAFETY HATS—*Flood Safety Products Co, 3035-37 W Lake St, Chicago 12, Ill.* 4-page bulletin 18 presents illustrated description of new line of hats and caps available in fiberglass, aluminum, or plastic-electrical shells. Plastic-zippered polyethylene suspension is easily removed for cleaning.

PARTS AND MATERIALS

33 BEARING BLOCKS AND TAKE-UPS — *Link-Belt Co, Prudential Plaza, Chicago 1, Ill.* 16-page book 2707 provides information on complete line of babbitted, bronze and plain bore bearing blocks and takeups including 119 new sizes in eight series. Design features and advantages, illustrations and descriptions of each type of block and takeup and its class of application are given. Specifications, dimensions, diagrams showing recommended loading ranges included.

34 CYLINDERS—*Airmatic Valve Inc, 7817 Associate Ave, Cleveland 9, Ohio.* 24-page bulletin 91017 contains detailed description of line of air, water, and oil cylinders and valve-cylinder combina-

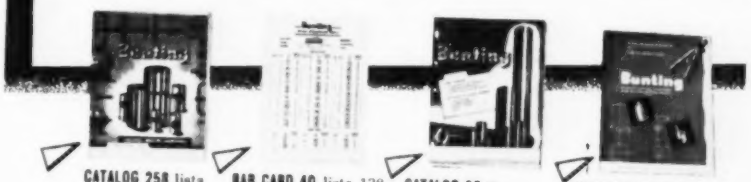
"One more 'upsy-daisy' out of you and I'll bust you one!"

CHECK LIST for a BEARING BUYER

PRODUCT — **BEARINGS, BUSHINGS AND SPECIAL PARTS OF CAST BRONZE OR SINTERED METALS ALCOA® ALUMINUM BARS**

FIRM NAME — *The Bunting Brass and Bronze Co., Toledo 1, Ohio*

	YES	NO	REMARKS
Are its products available from stock?	✓		Readily
Do local distributors have stocks?	✓		All over America
Cast Bronze Bearings	✓		866 sizes
Sintered Oil-filled Bronze Bearings	✓		667 sizes
Cast Bronze 13" Bars	✓		267 sizes
Sintered Oil-filled Bronze 6½" Bars	✓		84 sizes
Aluminum 13" Bars	✓		138 sizes
Is it a high quality product?	✓		Bunting 72 Bronze Alloy (SAE 660) Alcoa Aluminum
Are stock sintered bearings made to ASTM Standards?	✓		Always
Any restrictions on quantity?		✓	Small lots at big run prices
Does it render extraordinary service in emergencies?	✓		Large reserve facilities
Does it have ample production capacity?	✓		Two large modern plants
Is the range of stock sizes complete?	✓		Meets every usual need
Does the company publish catalogs?	✓		See below
Does it publish technical data?	✓		In all catalogs and in special literature
Does the company make products to blueprint?	✓		Over 50,000 patterns for customer free use
Does it give competent engineering aid?	✓		It's free
Is the company well established?	✓		Over 50 years



CATALOG 258 lists Electric Motor Bearings.

BAR CARD 40 lists 138 sizes of Bunting Bearing Aluminum 13" Bars.

CATALOG 58 lists Bunting Cast Bronze and Sintered Oil-filled Bronze Bearings and Bars.

BUNTING'S "ENGINEERING HANDBOOK ON POWDER METALLURGY" details manufacture and use of sintered metal bearings and parts.

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Bunting® local distributors are listed in classified section of telephone directory under "BARS-BRONZE" or "BEARINGS-BRONZE"

Where strength is a factor

HOT FORMED NUTS

. . . Induction heated

Through induction heating and modern forming equipment, these Screw and Bolt nuts attain superior finish, wrenching qualities and tolerances.

The instant heating process eliminates cold working strains prevalent in conventional cold made nuts, minimizing oxidation. Then modern equipment forms these nuts to geometric perfection and exceptionally close tolerances . . . for secure, snug-fitting connections.

When rugged operating conditions exist, be sure . . . specify hot formed nuts by Screw and Bolt. Send for illustrated brochure. VMA 6733

SCREW AND BOLT CORPORATION OF AMERICA P.O. Box 1708 Pittsburgh 30, Pa.

Formerly Pittsburgh Screw and Bolt Corporation

SERVES THE NATION

America's Most Complete Line of Industrial Fasteners

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tions for automation applications. Specifications, ordering information, features.

35 V-BELT DRIVES—*R & J Dick Co, Totowa, NJ.* 68-page manual presents data for design of multiple V-belt drives with company's Dickrope V-belts; uses new standard V-belt code designation system. Engineering data covers all phases of selection and design of drives from ½ to 1000 hp, including information on installation and service.

36 STAINLESS COMPARISON CHART —*Peter A Frasse & Co, 17 Grand St, New York 13, NY.* Data chart, Sec A, No. 4, provides comparison of properties for 18 different grades of stainless steel including the recently developed precipitation hardening grades 17-4 and 17-7. Using bar graphs, this 8½ x 11-in. chart compares 9 important factors: tensile strength, yield, izod, creep, machinability, thermal conductivity, scaling resistance, thermal expansion, and relative base prices. Corrosion resistance table is included.

37 DC MOTORS AND GENERATORS —*Marathon Electric Manufacturing Corp, Wausau, Wis.* Bulletin SB-182 describes new line which feature interchangeability, rating for rating, with corresponding NEMA ac induction motors. Includes specifications of units in frame sizes from 180 through 580.

38 AIRCRAFT BOLTS — *Standard Pressed Steel Co, Box 875, Jenkintown, Penna.* 4-page bulletin, Form 2527, gives details on line rated at 260,000 to 290,000 psi tensile strength. Contains detailed performance data that includes graphs charting tensile and fatigue strength characteristics of the new fasteners, designated EWB 26, and other comparable aircraft bolts. Relative tensile strengths for various bolt diameters are plotted. Includes design drawings and complete specifications.

39 TOOL STEEL—*Uddeholm Co of America, 155 E 44th St, New York 17, NY.* 8-page booklet provides information on UHB Premo, a steel used for producing molds for plastics and die casting dies for zinc and other metals with low melting points. Describes characteristics; detailed data given for forging, stress relieving, carburizing, quenching, tempering, and martempering. Photos show various molds and dies for typical applications. Graph compares good hobbability with two other popular tool steels.

40 MARASET TOOLING RESINS — *Marblette Corp, 37-31 Thirtieth St, Long Island City 1, NY.* Guide to plastics tooling materials is a chart that uses color bands for quick differentiation between product groups: epoxy laminating and coating resins, casting resins, high-temperature resins, adhesive and sealing compounds. Properties, end uses included.

41 COMBINATION STARTERS—*Westinghouse Electric Corp, PO Box 2099, Pittsburgh 30, Penna.* 11-page booklet B-7322 covers six important safety features of new Type L combination safety starters. Designed to meet JIC recommendations, they are used to control industrial equipment such as heavy machine tools.

● MEEHANITE BAR STOCK, BUSHINGS, SHAPES—*Meehanite Metal Corp, 714 North Ave, New Rochelle, NY.* 16-page booklet illustrates typical parts machined from Meehanite standard shapes. Shows how bars, bushings, and shapes, cast in standard sizes to exacting physical properties are used for cams, pistons, gears, plates, box, and flat parallels and many other engineering components. Request direct on company letterhead.

42 STAINLESS COLD HEADING WIRE—*Universal-Cyclops Steel Corp, Station St, Bridgeville, Penna.* 4-page brochure contains chart that compares cost, corrosion resistance, and cold heading characteristics of commonly used grades.

43 ELECTRIC MOTORS—*Hyvyn Electromotive, Telecomputing Corp, 915 North Citrus Ave, Los Angeles 38, Calif.* 4-page illustrated brochure describes features of new line of extreme precision hysteresis synchronous electric motors for use in tape transports, turntable drives, missile and aircraft instrumentation. Details performance characteristics and dimensions; describes construction and design features.

44 RECOMMENDED PIPING PRACTICE—*Lunkenheimer Co, Cincinnati 14, Ohio.* Wall chart is divided into five illustrated sections: basic valve types; connections normally used; installation and maintenance tools; installation; operation and maintenance.

45 INDUSTRIAL CHEMICALS — *Dow Chemical Co, Midland, Mich.* 1959-1960 edition of company's 44-page general catalog lists properties and uses of established products and developmental items. Features and expanded section on plastics and coatings products.

46 ALLOY STEEL SCREWS—*Mac-it Parts Co, East Liberty St, Lancaster, Penna.* 36 page illustrated handbook No. 500 contains technical information and specifications on complete line including new IB socket head cap screw; flat head and button head socket cap screws, and socket head shoulder screws.

47 OLIN ALUMINUM PIG, INGOT, AND BILLET—*Henning Brothers & Smith, Inc, 91-127 Scott Ave, Brooklyn, NY.* 8-page booklet lists in chart form: typical physical and mechanical properties of aluminum casting alloys; comparative ratings of aluminum castings by various casting methods; pig, ingot, and billet compositions.

MISCELLANEOUS

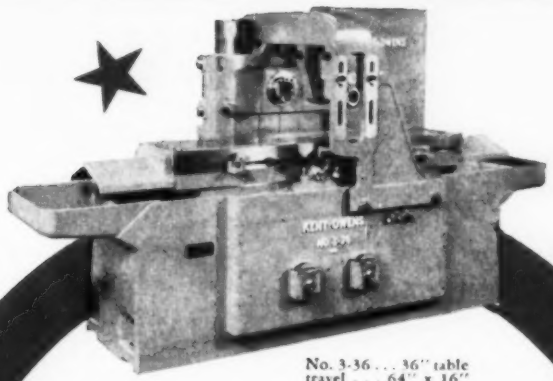
48 "THIS IS GULTON INDUSTRIES" —*Gulton Industries, 212 Durham Ave, Metuchen, NJ.* 4-page brochure outlines the basic product lines of the ten divisions and subsidiaries; lists in detail the more than 100 product lines of electronic, electro-mechanical, and ultrasonic equipment manufactured by the firm.

49 INTERCHANGEABLE TYPEWRITER TYPE—*Remington Rand Co, 315 Park Ave South, New York 10, NY.* 12-page booklet R-8964.6 describes method of using an electric typewriter for quick, convenient typing of special symbols and equations needed in the field of engineering. With interchangeable type heads, typist can insert special type characters in seconds. Typeface snaps into place in one operation and is locked, or removed, with special magnetized tweezers.

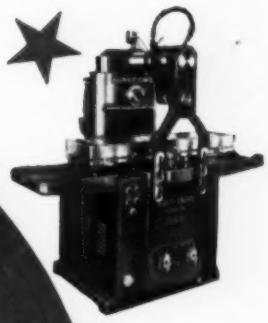
"I figure each man would save 40 minutes a day if you didn't give them a choice on the machine."

Every one a Star

for speedy accurate milling!



No. 3-36 . . . 36" table travel . . . 64" x 16" table . . . full automatic hydraulic feed.



No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

You'll turn out milling jobs with stepped up speed and accuracy with the work on Kent-Owens Machines! These extra-rugged Millers are performance-proved . . . simple . . . versatile . . . practical in every detail. Advanced features throughout! Twin-post head mounting assures balanced load. Only two gear contacts, motor to spindle, means greater cutting efficiency. Check your needs! Write today for bulletins on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines. Kent-Owens Machine Co., Toledo, Ohio.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table travel . . . head counter-balance is adjustable.

CALL ON

KENT-OWENS

for milling machines

KENT-OWENS REPRESENTATIVES

BOSTON
General Machinery Corp.

BUFFALO
Beesley-Hofmann Mach'y Co.

CHICAGO
Four States Mach'y Company

CLEVELAND
Garco Machinery, Inc.

DALLAS
Hunter Machine Tool Co.

DAYTON
C. H. Gosiger Mach'y Co.

DETROIT
A. C. Haberkorn Mach'y Co.

FT. WAYNE
Oatis Machinery Co.

GRAND RAPIDS
Joseph Monahan & Co.

HAMILTON, ONT.
F. F. Barber Mach'y Company

HARTFORD
Harrington-Wilson-Deane Corporation

HOUSTON
Oliver H. Van Horn Co., Inc.

INDIANAPOLIS
Oatis Machinery Co.

KANSAS CITY
Eichman Machinery Co.

LOS ANGELES
Machinery Sales Co.

MILWAUKEE
Four States Mach'y Company

MINNEAPOLIS
The Sanerlee Company

MOLINE
John J. Normoyle Co.

MONTREAL
F. F. Barber Mach'y Co.

NEW ORLEANS
Oliver H. Van Horn Co., Inc.

NEW YORK
Harrington-Wilson-Deane Corporation

OMAHA
The Balbach Co.

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Calco Machinery Company

PITTSBURGH
Barney Machinery Company

ROCHESTER
Schiefer-Philipp Machinery Corp.

SAN FRANCISCO
Bulotti Machinery Co.

ST. LOUIS
Wm. Scheer Company

SEATTLE
Starbuck Machine Tool Co.

SYRACUSE
J. F. Owens Mach'y Company

TORONTO, ONT.
F. F. Barber Mach'y Company

WINDSOR, ONT.
F. F. Barber Mach'y Company

Another Tinnerman Original...

Self-retaining "U" and "J" SPEED NUTS® cut assembly costs up to 50% or more!

If you are worried about rising assembly costs, let one-piece "U" and "J" SPEED NUTS keep costs down . . . and improve your product.

They can't fall off, once they've been pressed into screw-receiving position. No welding, staking or other secondary fastening devices needed. You eliminate lock washers – spring steel SPEED NUTS are self-locking, make vibration-proof attachments.

SPEED NUTS are ideal for blind assembly or hard-to-reach locations. Apply them *before* you paint panels without danger of paint-clogging. Or *after* porcelainizing, without damage to finishes. The "U" type is similar to the "J" type, shown above, but is used where full bearing surface on the lower leg is required.

A free Fastening Analysis can tell where SPEED NUT brand fasteners belong on your products. Call your Tinnerman representative – he's listed in most major telephone directories. Or write to:

TINNERMAN PRODUCTS, INC.
Dept. 12 • P. O. Box 6688 • Cleveland 1, Ohio

TINNERMAN
Speed Nuts®

FASTEST THING IN FASTENINGS®

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario. GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S. A. 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Hecano-Boody GmbH, Heidelberg.

Clearing Division of US Industries Inc, Chicago, has named **Eugene P Cunningham** senior vice president. He was formerly vice president, sales

Scully-Jones & Co, Chicago, has appointed **Hans W Deutsch** manager of the Special Products Division. He was previously consulting engineer to bearing manufacturers

NAMES IN THE NEWS...

Timken Roller Bearing Co, Canton, Ohio, has appointed **S F Bennett** managing director of **British Timken,** Division of Timken Roller Bearing. He has been assistant managing director since 1952. **G F Copeland** has been named managing director of the Brazilian plant of Timken, now under construction. He has been serving as engineer in charge of the Bearing Division industrial engineering.

Westinghouse Air Brake Co, Pittsburgh, has appointed **Charles D Howell** assistant vice president, manufacturing. He was formerly associated with Ford Motor Co in various managerial positions related to production and manufacturing.

Gabriel Co, Cleveland, has appointed **Robert T Hood** president and general manager of the Gabriel Division, manufacturer of automotive shock absorbers. He will continue to serve as corporate vice president and treasurer.

Westinghouse Electric Corp has appointed **William E Hoctor** manager of manufacturing at the Air Conditioning Division, Staunton, Va. He was previously general foreman at the Motor and Control Division in Buffalo.

F J Stokes Corp, Philadelphia, has appointed **Joseph P Mallee** product specialist on auxiliary equipment for tabletting. He joined the company in 1958 and during the past year has been handling sales engineering and technical service on the firm's new Tornado Mill, a whirling-blade granulator and pulverizer.

Powder Metallurgy Parts Manufacturers Association has elected **Carl J Demrick,** president of the Amplex Division of Chrysler Corp, Detroit, president of the Association. **Smith Bolton,** divisional president and general manager of US Graphite Co, Saginaw, Mich, has been elected vice president of PMPMA.

Yuba Consolidated Industries Inc has named **Karl A Gardner** vice president, engineering. He will make his headquarters at the company's engineering and marketing development center in Palo Alto, Calif.

Smith-Corona Marchant Inc, Oakland, Calif, has named **John D Kemper** vice president, engineering, of the Marchant Division. Previously chief engineer, he will continue to direct calculator and adding machine research, development, and engineering.

W L Maxson Corp, New York firm engaged in research, design, development, and production of electromechanical, electronic, and hydraulic equipment, has elected **W Hubert Beal** president and chief executive officer to succeed **Hugo A Leander,** named board chairmann. **William L Maxson Jr,** secretary, succeeds Mr Beal as vice president.

Allis-Chalmers Manufacturing Co has appointed **Harry M Raber** works manager of turbines at the A-C York Works. Formerly superintendent, he succeeds **Russell A Hedden,** now works manager of manufacturing, Industries Group.

General Electric Co has appointed **Richard J Keates** manager of manufacturing engineering of the phenolic products section of the Chemical Materials Dept at Pittsfield, Mass. He was formerly a process control engineer there.

Gulton Industries Inc, Metuchen, NJ, electronics firm, has appointed **David A Lupfer** general manager of the Materials and Ceramics Division. He was formerly a research physicist and development engineer with General Electric Co. **Robert Day** has been named general manager of the Instrumentation Division; **Dr Robert C Shair** is new director of research, Alkaline Battery Division; and **Harlan P Tripp** manager of the Ceramics Coating Department.

Volkert's two presidents . . .

Jack Kleinoder (left) and **Fred F Rimmler,** executives of Volkert Stampings Inc, New York, are heads simultaneously of two national trade associations of which their company is a member. Mr Kleinoder, secretary-treasurer of Volkert, served as president of the National Tool & Die Manufacturers Association during the past year, and Mr Rimmler, plant manager, has just been elected president of the Pressed Metal Institute

Now

AUTOMATIC POSITIONING

with the

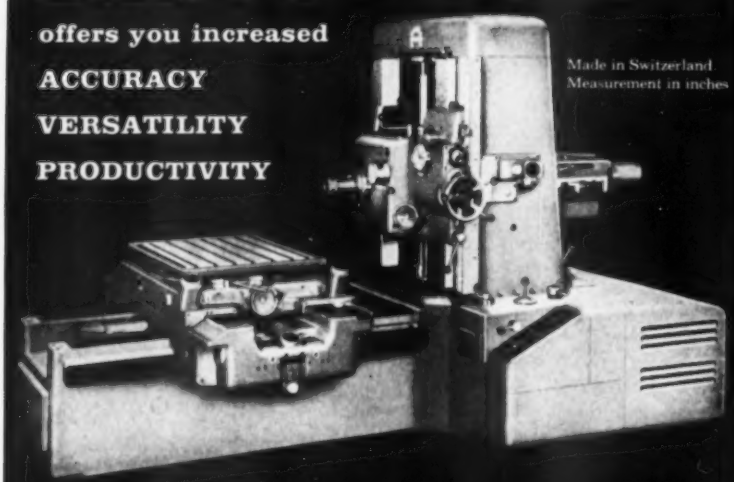
DIXI 75 horizontal optical jig borer

offers you increased

ACCURACY

VERSATILITY

PRODUCTIVITY



Made in Switzerland
Measurement in inches

- Automatic positioning can be changed instantly to manual operation
- Projected optical setting — direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference
- Simplified controls functionally arranged for greater operating speed and efficiency
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29⅝" cross travel; 23⅝" longitudinal travel; 25⅜" vertical travel
- Hydraulic feeds and infinitely variable spindle speeds
- Rear support optional

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York.—Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

Demonstrations upon request at our conveniently located demonstration centers.

MBI

M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.

475 Grand Concourse, Bronx 51, N. Y.

"Over 25 years' experience in designing and building machinery."

NAMES IN THE NEWS . . .

Electric Autolite Co, Toledo, Ohio, has appointed **D M Skirving** to succeed **J M Gerber** as western regional manager of the General Products Group with headquarters in Los Angeles. Mr Gerber was recently made operations manager for the Group's Hazleton, Penna, facilities. **Virgil R Steinmeyer,** previously Chicago district manager, replaces Mr Skirving as eastern regional sales manager. **John Winslow, Roy Stott,** and **Harry Seubert** have been named chief engineers of the Electrical Products Group. Mr Winslow will direct the starting motor section; Mr Seubert the distributor section; and Mr Stott the generator section.

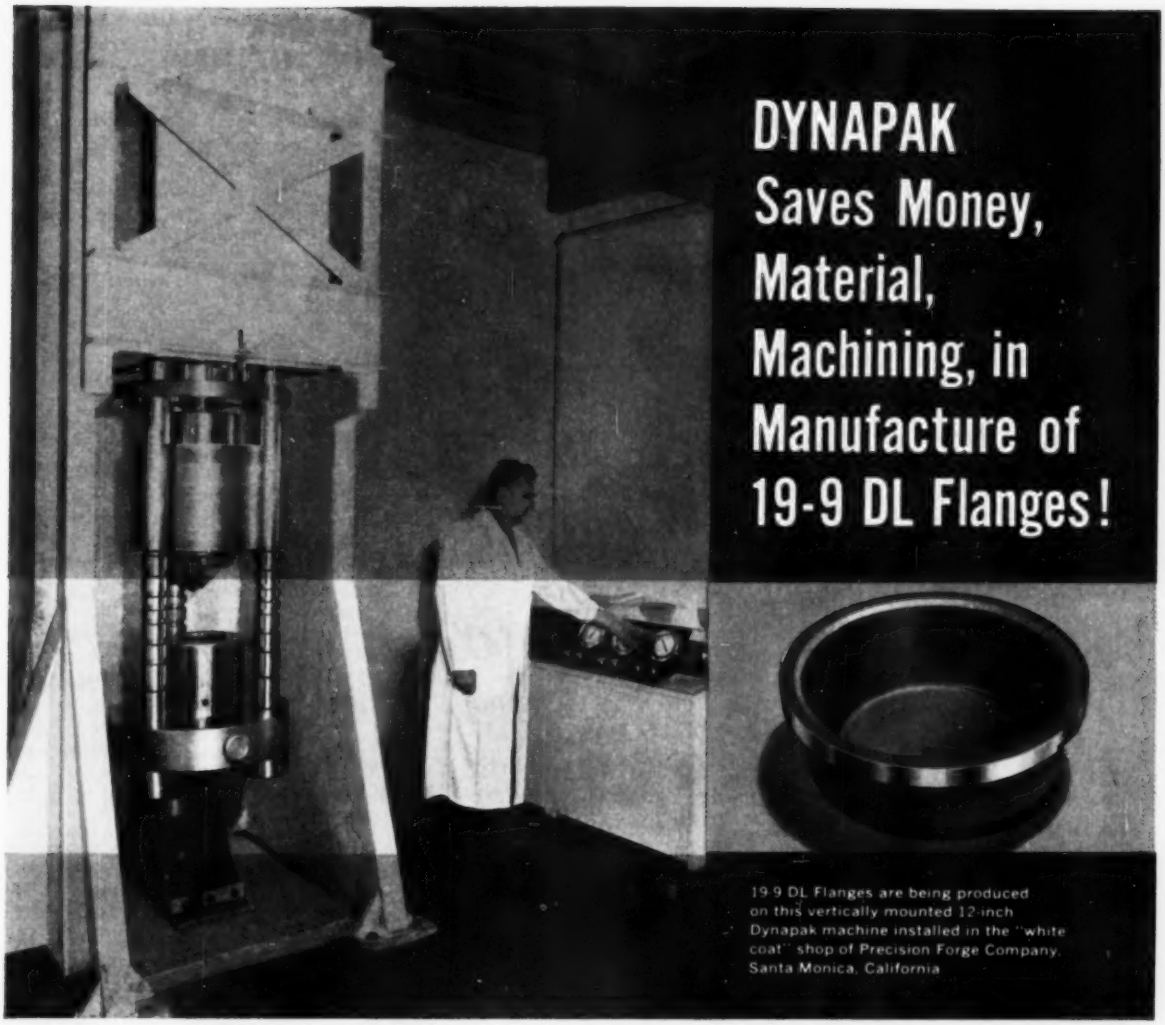
Consolidated Vacuum Corp, Rochester, NY, has appointed **Howard C Jones** assistant to the president and **Malvern J Gross** director of manufacturing to succeed Mr Jones. Prior to joining the company Mr Gross was vice president, manufacturing, of Tracerlab Inc and general manager of that company's subsidiary, Keleket X-Ray Corp.

Sparton Corp, Jackson, Mich, has named **John J Lynch** acting manager of the Electronics Division. He was formerly divisional military contracts administrator.

Computer Systems Inc (formerly **Mid-Century Instrumatic Corp**), New York manufacturer of analog computers and accessories, has named **Raymond W Carney** vice president, manufacturing. He was previously production manager. **Charles B Husick** has been moved up from manager to vice president of engineering and systems development.

American Biltrite Rubber Co, Cambridge, Mass, has appointed **Harry A Bourne** vice president, manufacturing, for its Boston Woven Hose & Rubber Division. He has been serving as factory manager. **Randolph H Jackson** has been promoted from director of sales to vice president, sales.

Altamil Corp, El Segundo, Calif, metalworking subcontractor in the aircraft and missile industries, has elected **G L Canfield** executive vice president. Mr Canfield was formerly president of Pryor Manufacturing Co; Altamil acquired the company's Twigg Industries Division recently. Mr Canfield will be in charge of



DYNAPAK Saves Money, Material, Machining, in Manufacture of 19-9 DL Flanges!

19-9 DL Flanges are being produced on this vertically mounted 12-inch Dynapak machine installed in the "white coat" shop of Precision Forge Company, Santa Monica, California

Here are the savings achieved in this Dynapak Application:

- MATERIAL: 60%
- TOOLING: 50% of the cost of conventional forging dies
- MACHINING: Reduced by more than 50% due to forging tolerances of $\frac{1}{32}$ in. and elimination of draft angle.

PLUS

- PRODUCTION RATES: 70-80 per hour
- SUPERIOR PHYSICAL CHARACTERISTICS: Greater strength, uniform and controllable work-hardening, Grain Size No. 11.

Dynapak, industry's first operational high-energy-rate machine tool, offers a breakthrough in metalworking's long-sought goal to produce forgings that can be used with little or no machining. This flange is just one of many forgings now being produced commercially by Dynapak. For complete information regarding application of pneumatically-energized Dynapak in your forging, extrusion, forming, or compaction operations, write, wire, or phone:

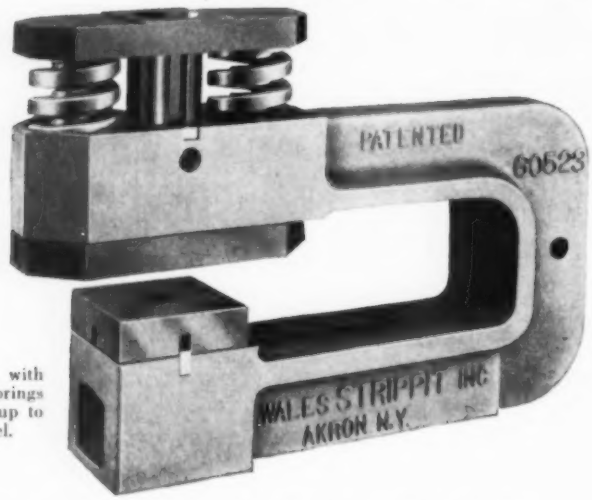
DYNAPAK

CONVAIR / A DIVISION OF GENERAL DYNAMICS CORPORATION

1243 Transit Avenue, Pomona, California • Telephone: NAtional 3-1561

new STRIPPIT PUNCHING UNITS

with DUAL-RANGE capacity!



● Strippit unit with mechanical springs for piercing up to .500 mild steel.

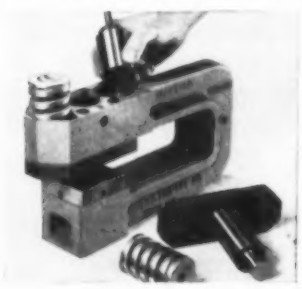
- Up to .500 mild steel, using removable Strippit mechanical springs
- Up to .750 mild steel, with interchangeable Strippit Hydra-Springs
- Convertible from .500 to .750 capacity in seconds, at minimum cost
- One heavy-duty holder for both capacity ranges
- Readily replaceable punch tips and dies — round, obround, square, shaped
- Keyed punch body keeps punches accurately aligned

USING STRIPPIT MECHANICAL SPRINGS

Max. punch dia.	Max. material thickness (mild steel)
1.375	.250
1.250	.375
1.125	.500

USING STRIPPIT HYDRA-SPRINGS

Max. punch dia.	Max. material thickness (mild steel)
1.375	.375
1.250	.500
1.125	.625
1.000	.750



◀ Mechanical springs are easily replaced with Hydra-Springs for punching up to .750 mild steel.

WRITE TODAY for the new Strippit General Catalog. It covers all details on this and all other Strippit units . . . plus the savings in tooling and press time effected with the famous cost-cutting Strippit System of fabrication.

WALES STRIPPIT INC.
200 Buell Road • Akron, New York

UNITED INDUSTRIES INC. HOUDAILLE

Manufactured in Canada by: Strippit Tool & Machine Company, Brampton, Ont.

NAMES IN THE NEWS . . .

Altamil's new eastern division and will operate from the main Twigg facility in Brazil, Ind. **B P Gibbons** has been appointed Altamil vice president, sales. Prior to joining the firm Mr Gibbons was associated with General Dynamics Corp's Convair Division as manager of materiel.

Sandvik Canadian Ltd, Montreal, has named **Eric G Messler** president and general manager. He was formerly vice president of Sandvik Steel Inc, Fair Lawn, NJ.

Moog Servocontrols Inc, East Aurora, NY, has named **George E Bartlett** engineering manager. He was formerly associated with the Cornell Aeronautical Laboratory as administrative engineer in the Aerodynamics Research Department.

American-Standard Industrial Division, Detroit producer of air conditioning and air handling equipment, has named **Albert O'B Andrews** president. He was previously vice president and controller.

Durant Manufacturing Co, Milwaukee manufacturer of production counters, has named **James K McGinley** general sales manager. He has been serving as regional sales manager of the central and southern areas of the US.

Shur-Lok Corp, Anaheim, Calif, manufacturer of precision specialty fasteners for aircraft, missile, and jet engines, has named **Jack M Cherne** assistant to the president. Mr Cherne was formerly with Vard Inc where he was director of engineering in aircraft actuators, transmission, and nuclear control rod activities.

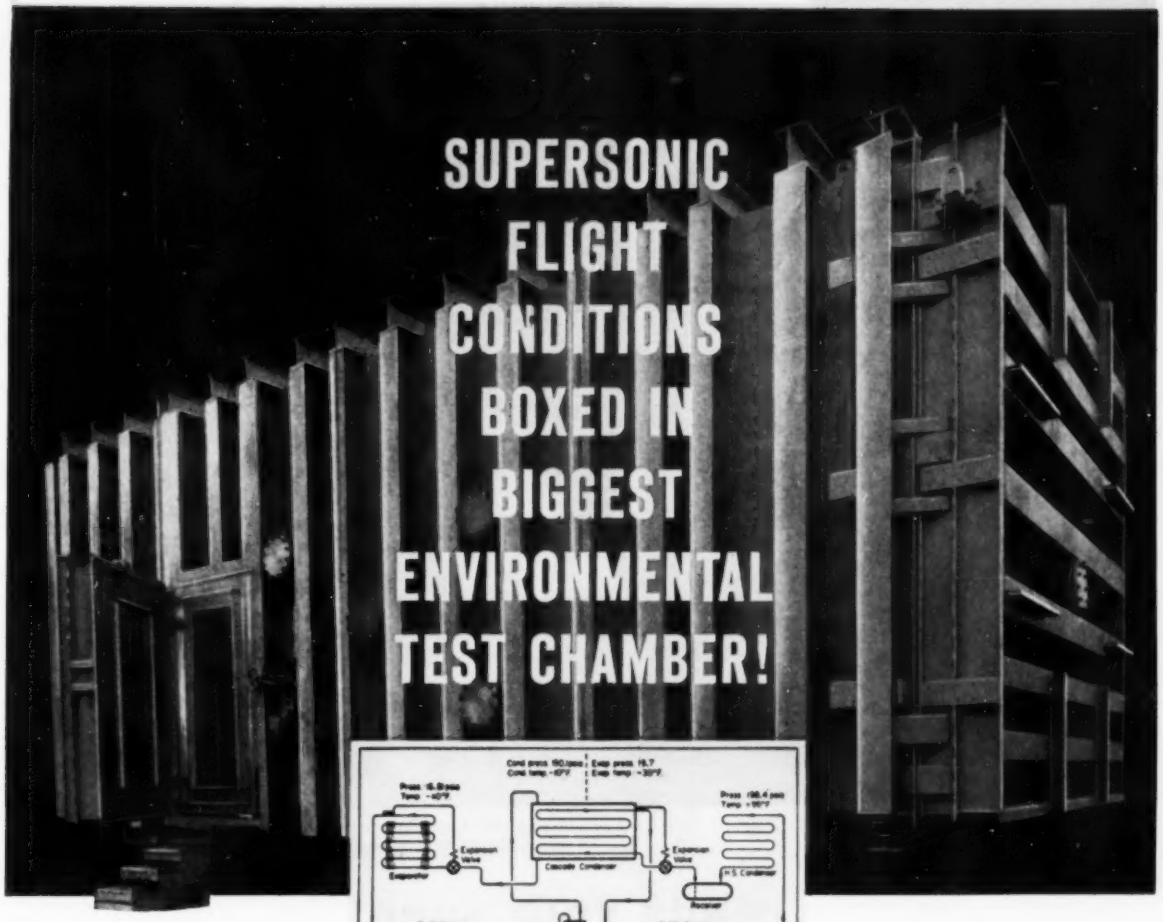
McCulloch Corp, Los Angeles maker of power chain saws and internal combustion engine products, has appointed **W B Burkett** chief engineer for the Chain Saw Division. He was previously assistant chief engineer of the Marine Products Division in Minneapolis.

OBITUARY

J Chester Bath, 67, vice president, treasurer, and a director of John Bath Co, Worcester, Mass, died Oct 19. Company, founded by his father in 1912, manufactures taps and gages.

Copper Alloy Bulletin

BRIDGEPORT BRASS COMPANY



Bridgeport Copper Tube Used for Refrigeration System

Called "Old High and Mighty" by its designer and builder, Tenney Engineering, Inc. of Union, N. J., this $500,000 chamber will simulate supersonic flight conditions for McDonnell Aircraft Corp., St. Louis.

The complete unit weighs 125 tons and has a temperature range from -100° to 1200°F with an altitude range from sea level to 125,000 to 150,000 ft.

Providing the great degree of cold for the chamber is the Tenney-patented Cascade Condenser System, a custom-fabricated refrigeration and vacuum system. It is exceptional in that it uses two coolants—Freon 13 and Freon 22—the latter coolant condenses the Freon 13 below the freezing point.

Naturally, the system must be both absolutely leakproof and corrosion resistant and the materials used must be easily workable and readily available. To meet these requirements, the designers chose Bridgeport Type M, 5/8" to 1 5/8" copper tube for the refrigeration system's vacuum pump interconnections, and Bridgeport Type L copper tube for the refrigeration lines.

Your needs may not be as exceptional as those cited here, but you can't do better than buy Bridgeport. Your nearby Bridgeport Sales Office has information on all of Bridgeport's metals from Aluminum to Zirconium. Call today, or write Dept. 3012 for complete list of products. Bridgeport Brass Company, Bridgeport 2, Connecticut.

Using this microphotometer, Jessop can detect and measure the per cent of even trace elements in a sample of specialty steel.

"How Jessop reads your specialty steels!"

—C. M. Carlisle, DIRECTOR OF ANALYTICAL CHEMISTRY

"If you're ever near the Jessop plant, stop in and ask for a tour through our chemical laboratories.

"There you'll see how Jessop makes certain you get the exact per cent of alloying elements specified for your specialty steel.

"For example, you'll see a *microphotometer* — that's what I'm peering at so intently in the above photograph!

"I'm studying a film showing the spectrum of a sample of steel from Jessop's No. 2 electric arc furnace. Each chemical element in this specialty steel appears as a distinct line. By reading these lines, I can detect even minute *traces* of elements and after some simple calculations, determine the per cent of each."

This modern chemical laboratory is one more reason why you get your specialty steel tailor-made to your order . . . and you get it on time. **Specify Jessop . . . and then relax!**

VMA 6719

JESSOP
STEEL COMPANY
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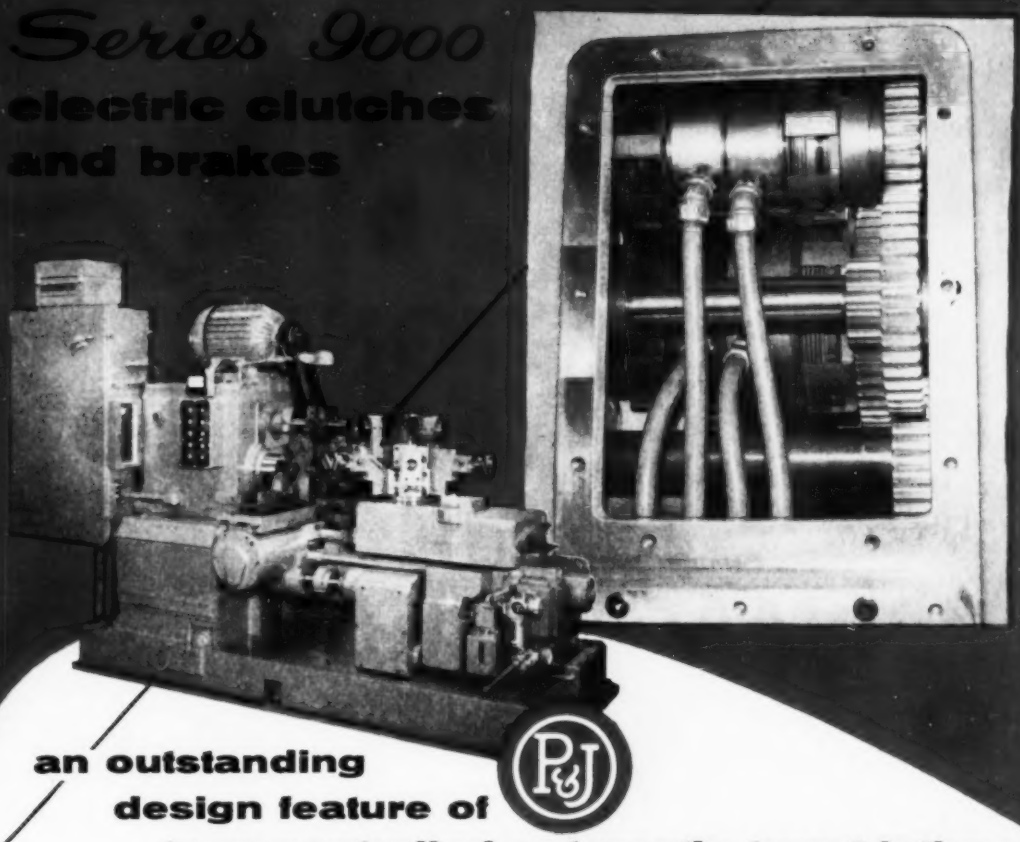
Subsidiary Companies:
Green River Steel Corporation, Owensboro, Kentucky • Jessop Steel International Corporation, New York City
Jessop Steel of Canada, Ltd., Wallaceburg, Ontario • Steel Warehousing Corporation, Chicago, Ill.

Stainless, alloy, tool, cast-to-shape, and forging steels, precision ground flat stock, and other specialty steels

CIRCLE 360 READER SERVICE CARD

Maxitorq

Series 9000 electric clutches and brakes



an outstanding design feature of tape-controlled automatic turret lathes

Five Maxitorq Series 9000 Electric Clutches are used in the all-new Potter & Johnston No. 3E-15 Tape-Controlled Automatic Turret Lathe. Four are used in the headstock to provide automatic spindle speed changes and a fifth is used as a master clutch in the feed drive. These clutches of advanced design have PROVED their ability to assure consistent, positive and extremely fast action; essential to these machines. They transmit full load, are self-compensating for wear and permit great flexibility in control.

With operation induced entirely by magnetic flux, Maxitorq Series 9000 Electric Clutches are well adapted to a wide range of machine tool drives. They are simple and rugged in design, require no adjustments, can be used *either as a clutch or brake* and are built to American Machine Tool Standards. Disc separators not only separate discs, providing a drag-free neutral without heating, but also break up residual magnetism and permit extremely fast, positive action.

The 9000 Series Clutches have a minimum of moving parts and the electrical operating unit remains stationary, hence, there are no brushes, slip rings or complex wiring. Maxitorq Clutches operate on 110 V. A. C. rectified to 90 V. D. C. Other voltages on special order.

If you have a clutch or brake application where you are looking for new and improved performance, bring your problem to us.

Phone, wire or write Dept. AM for Series 9000 Bulletin.

The Carlyle Johnson Machine Company, Manchester, Conn.

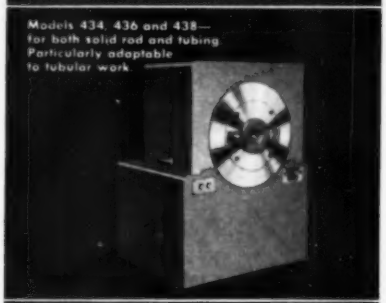
3CJ59

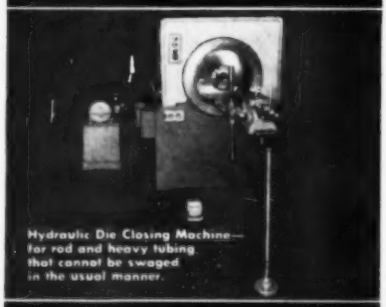
CIRCLE 361 READER SERVICE CARD

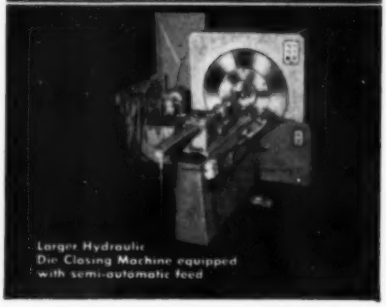
BIG...OR SMALL

(From 6" big to .008" small)

TORRINGTON ROTARY SWAGING MACHINES WILL DO THE JOB





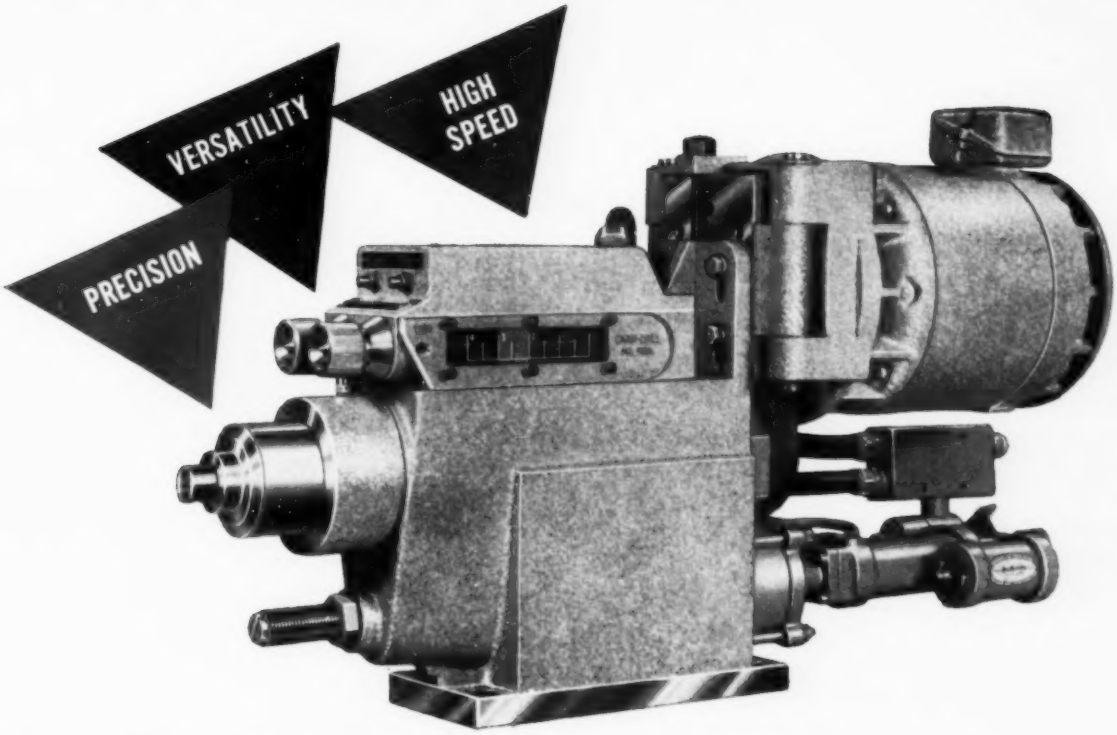


Pointing, tapering, reducing or bonding metal parts? You can do the job faster at lower cost with Torrington Rotary Swaging Machines. The metal is shaped by hammering between dies. No stock is wasted. You get a full pound of parts from every pound of metal. You save time, metal and labor.

And you profit from the unparalleled engineering assistance Torrington provides. As the originator of the swaging process and the largest user of swaging equipment in the world, we can place at your service more swaging experience than any other company. Our experimental shops are available for working out your special problems. If you have a part that can be swaged we have the knowledge and skill to produce the dies to swage it. Bring your swaging problems to Torrington—we can provide the solutions. The Torrington Company, Swaging Machine Division, 200 North Street, Torrington, Conn.

TORRINGTON ROTARY SWAGING

SWAGING HEADQUARTERS, U. S. A.



are a few of the outstanding features of the

BELLOWS "Carbi-Drill" DRILL UNIT

- Capacity up to 5/8" diameter drill in mild steel.
- Runout will not exceed .001" T.I.R. in full 4" stroke.
- Depth accuracy .003" with standard limit switch; .001" with optional Bellows BT-1 Timed Dwell Control.
- Stroke adjustable from 1½" to 4", with optional stops to permit shorter stroke lengths. Thrust is equal to 10 times applied air pressure.
- Spindle speeds available from 609 RPM to 6275 RPM.

This rugged, heavy-duty drill unit is ideal for tool-room built special purpose machinery for drilling, tapping, reaming, counterboring, etc. It can be mounted in any position. Units can be easily synchronized electrically with each other or with other Bellows "Controlled-Air-Power" devices for fully automatic operation. Air-powered rapid advance, controlled hydraulic feed rate, air-powered rapid retract provide maximum speed with feed rate adjustable for any tool working in any material.

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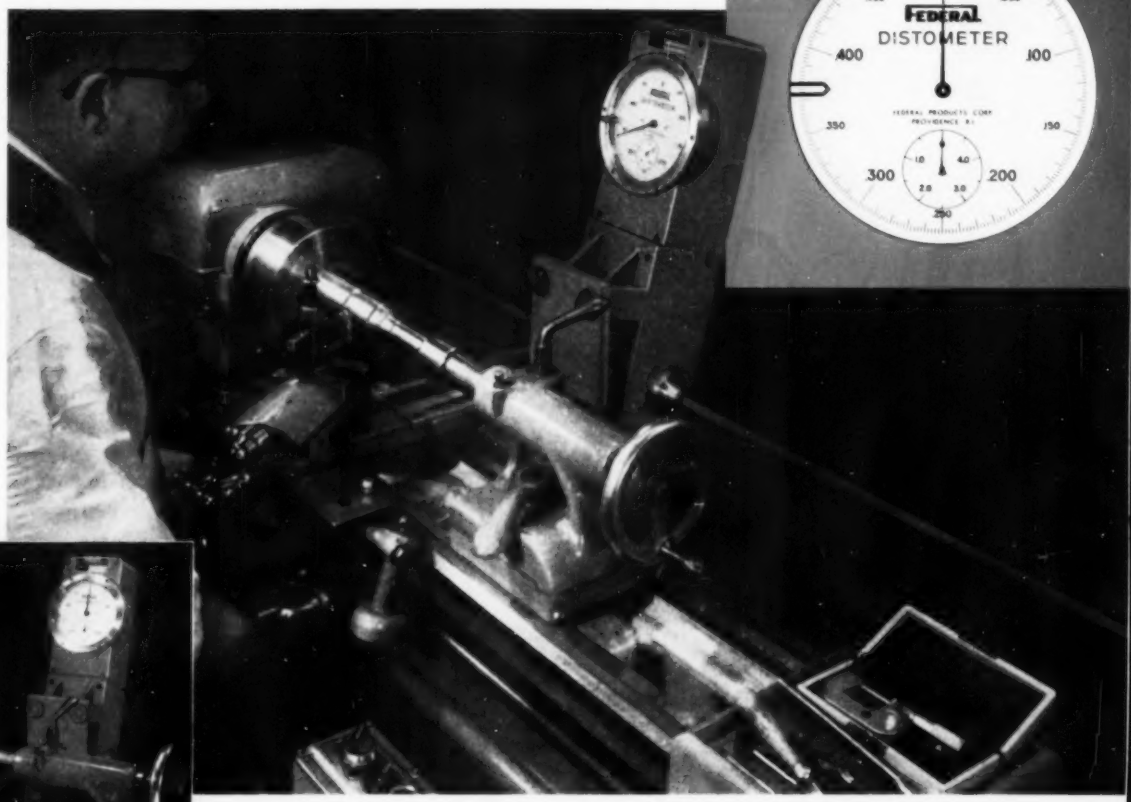

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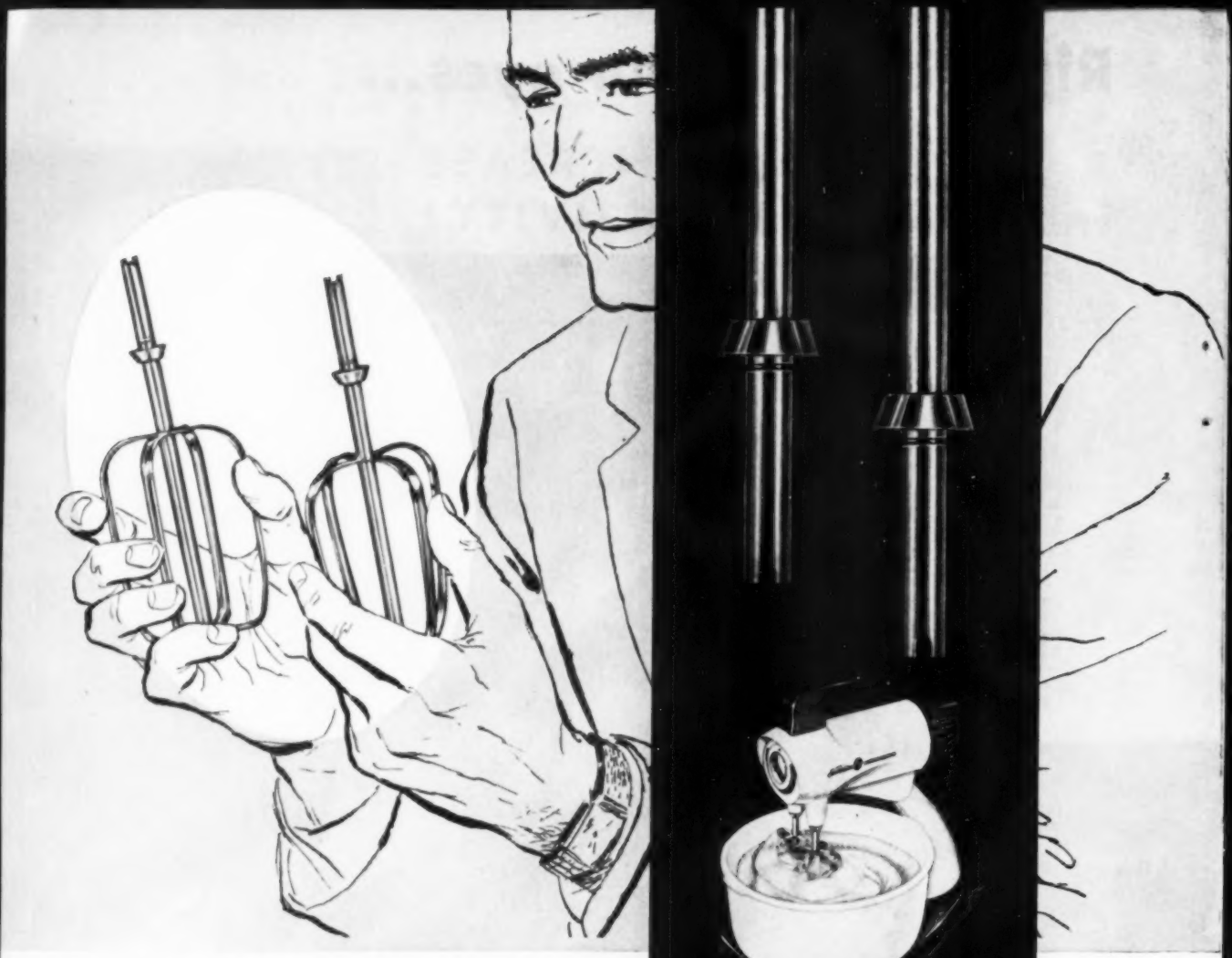

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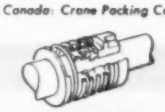

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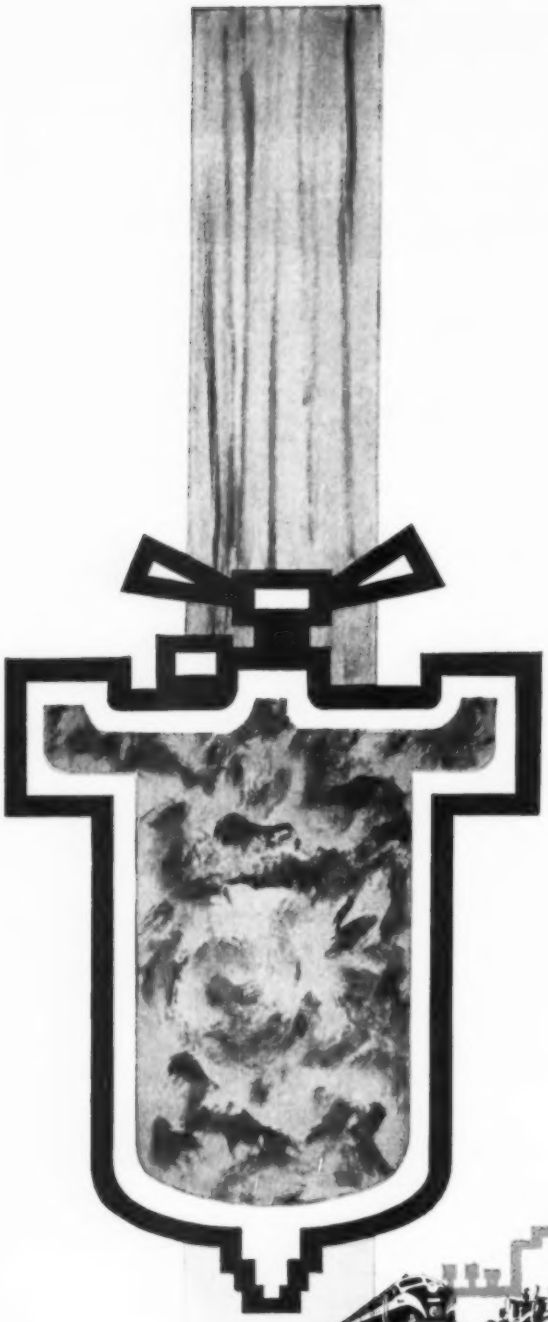

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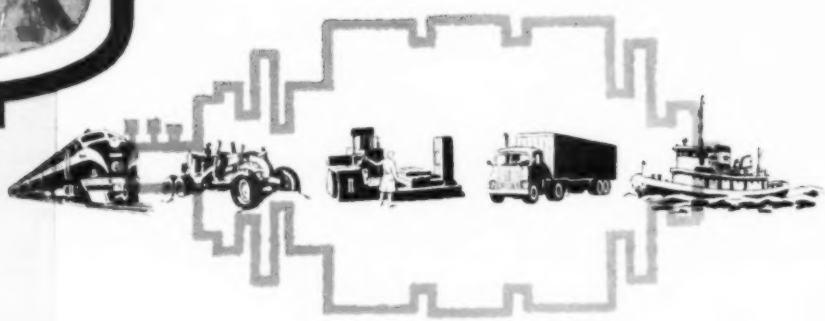

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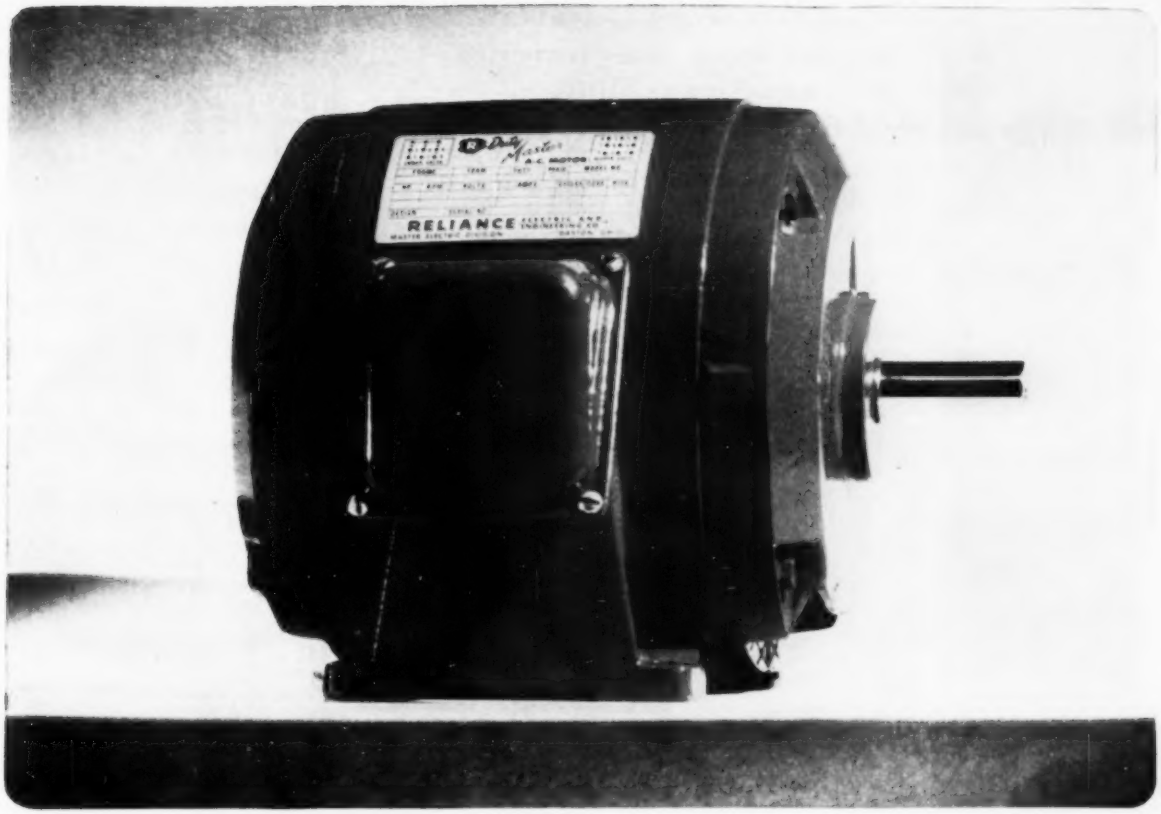

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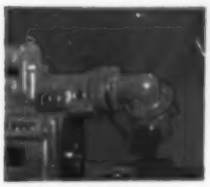

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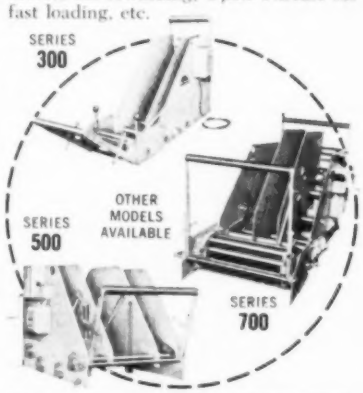

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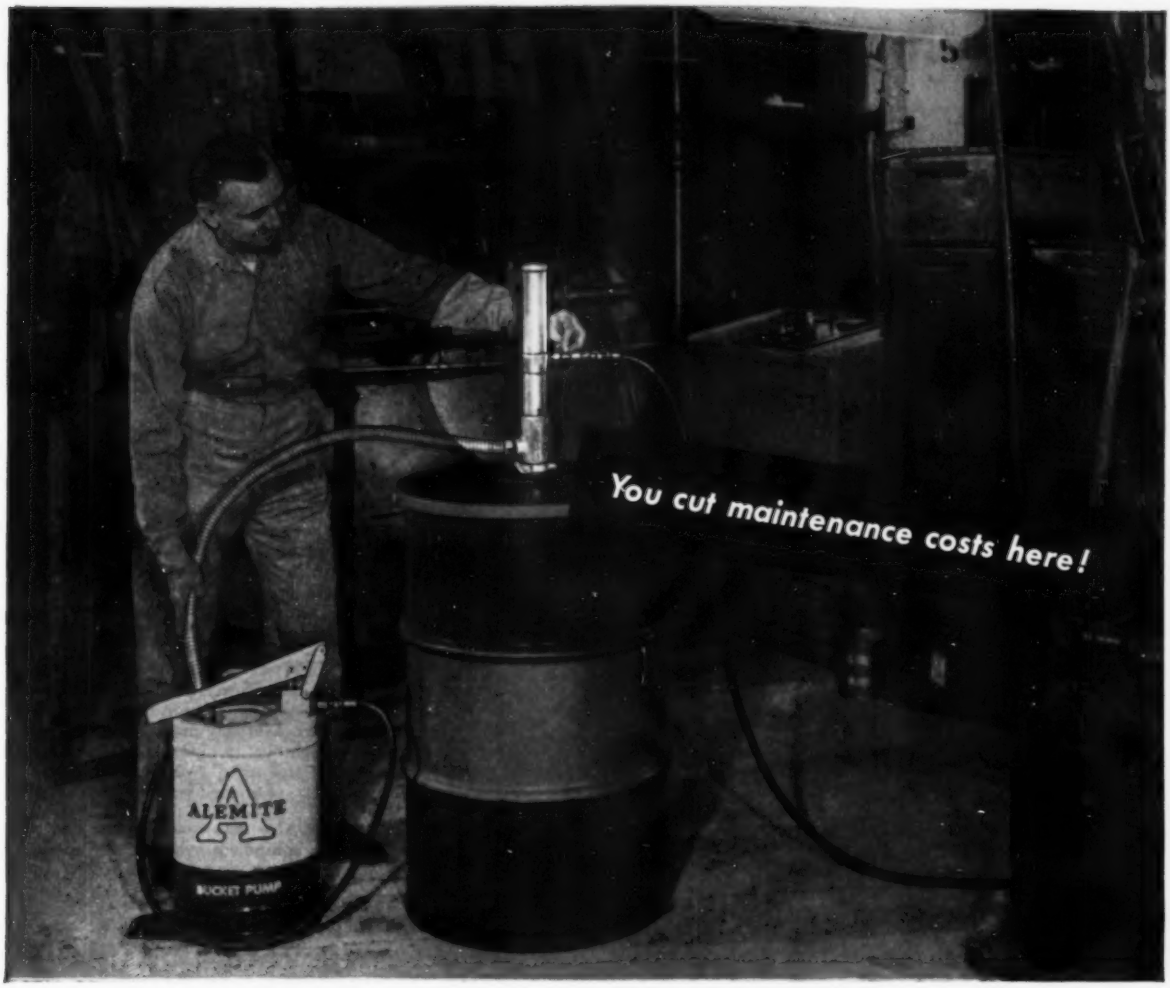

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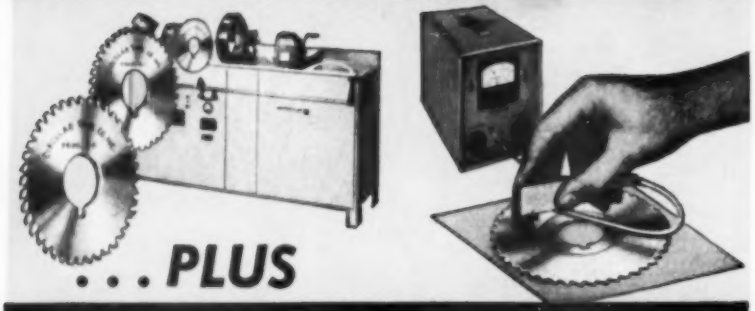

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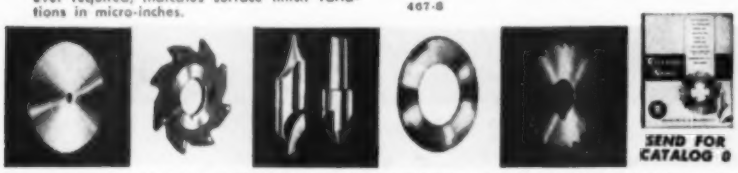

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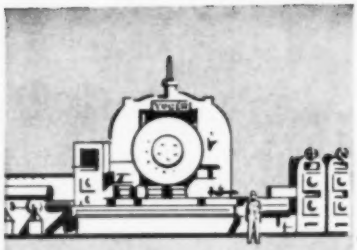

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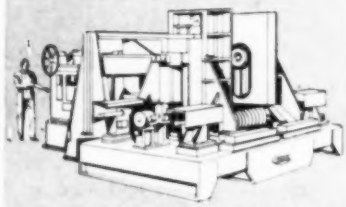

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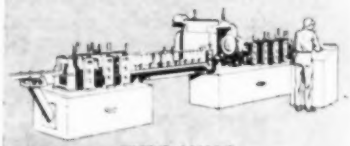

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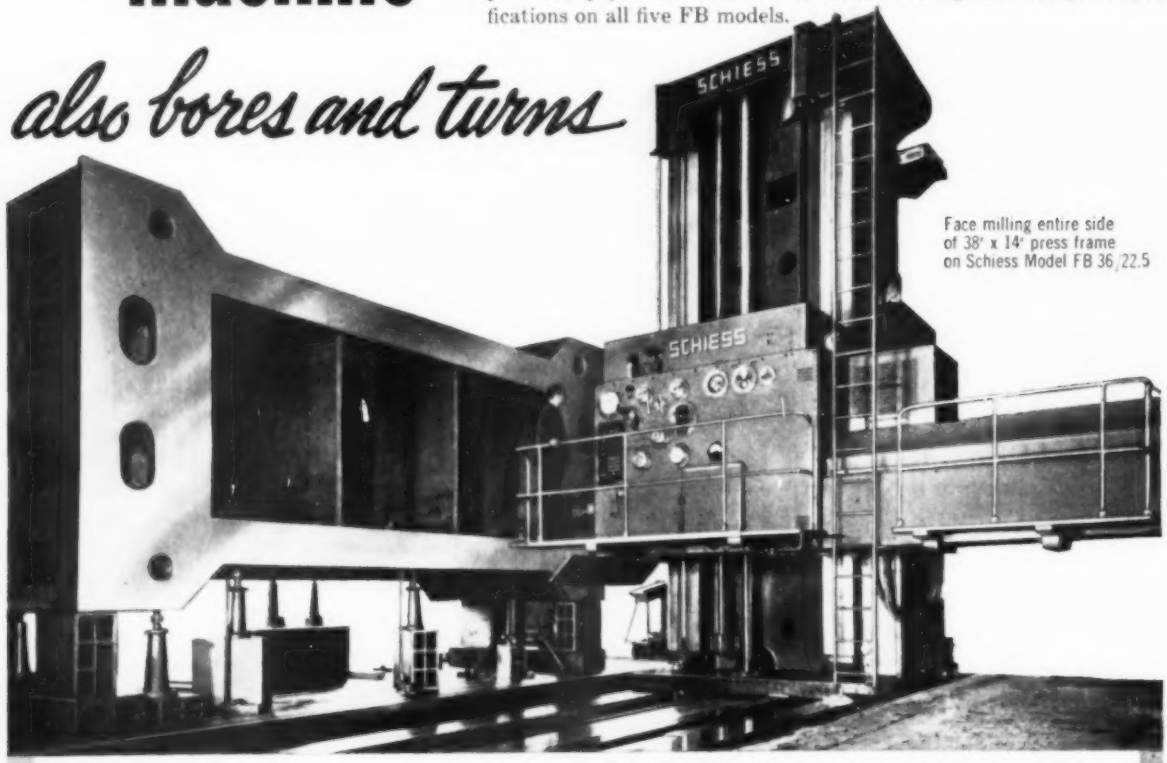

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WALDRICH SIEGEN

combined planer and milling machine

No need to risk the inaccuracies that come from moving a workpiece weighing up to 100 tons from machine to machine for different operations. One set-up is all you need with this Waldrich Siegen machine. And just think of the tremendous savings in set-up time and costs.

Three milling heads take care of milling, boring and thread cutting operations; another head does planing and grinding; and there's a planer side head, too.

The Waldrich patented tool retracting mechanism in the planer head raises tool in a straight vertical plane after unclamping, repositions tool automatically, then reclamps. Cross rail is clamped hydraulically in exact horizontal position, located by separate electric drive. Built-in optics confirm accurate location.

Rigid, you bet—from top to bottom! Waldrich construction features a base plate crossing under machine and tying columns and bed into one ruggedly rigid unit. And there's a total of 900 h.p. working for you.

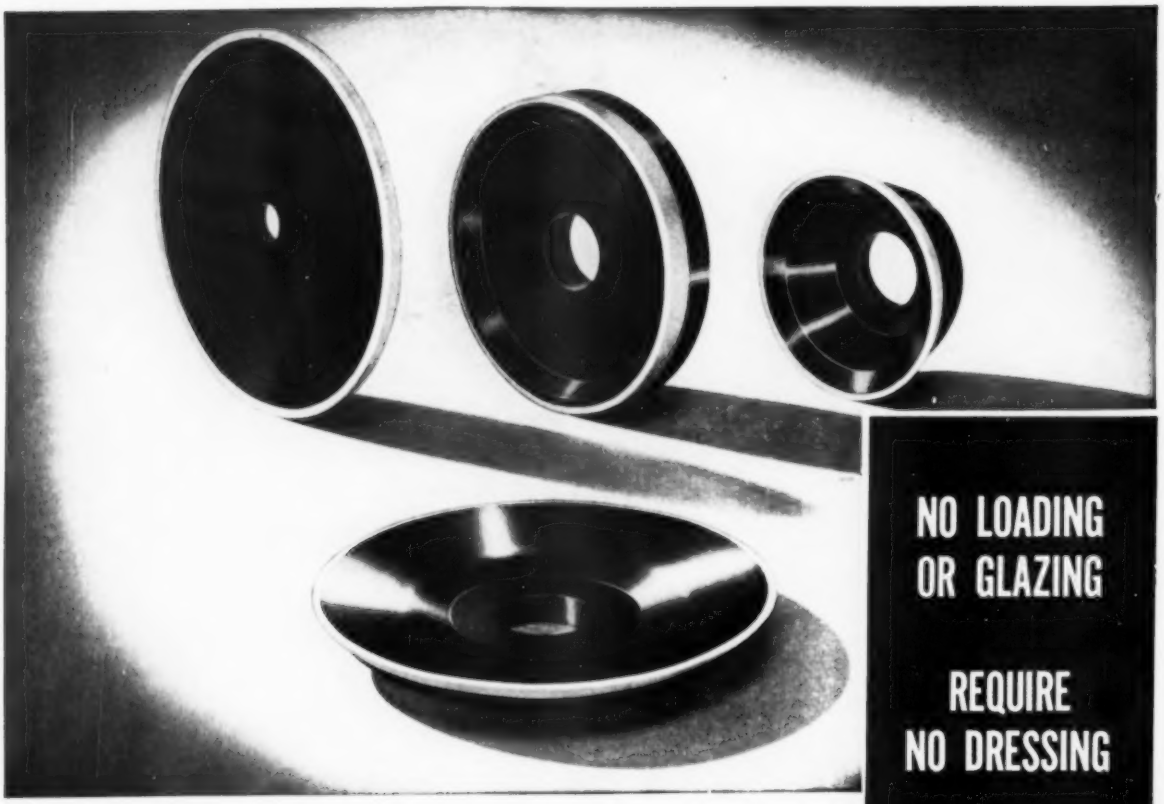
Write for all the specs on this mammoth producer. And ask a Waldrich engineer to discuss them in detail—in terms of your production needs.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA

CIRCLE 382 READER SERVICE CARD



NO LOADING OR GLAZING

REQUIRE NO DRESSING

BONDED FOR SPECIFIC GRINDING REQUIREMENTS

NATURAL OR MAN-MADE DIAMONDS

MANHATTAN DIAMOND WHEELS

CUT FASTER, COOLER . . . LONGER

Every Manhattan Diamond Wheel is specially *bonded* to assure precision grinding at top speed without loading or glazing. Resinoid bonded for tungsten carbide grinding, they cut cool and free with lightest pressure . . . eliminate danger or damage to heat-sensitive carbide. Special metal bonds give you the finish you want for glass, quartz and ceramics. They require no dressing — for either wet or dry grinding.

Manhattan Diamond Wheels give you faster, cooler cutting action *plus* higher wheel efficiency and longer life on the toughest jobs. Specify from Manhattan's wide variety of surface-contact shapes . . . in the diamond concentration and grit size best suited for your surface, cylindrical, or internal grinding operations. You get "More Use per Dollar" with Manhattan Diamond Wheels.

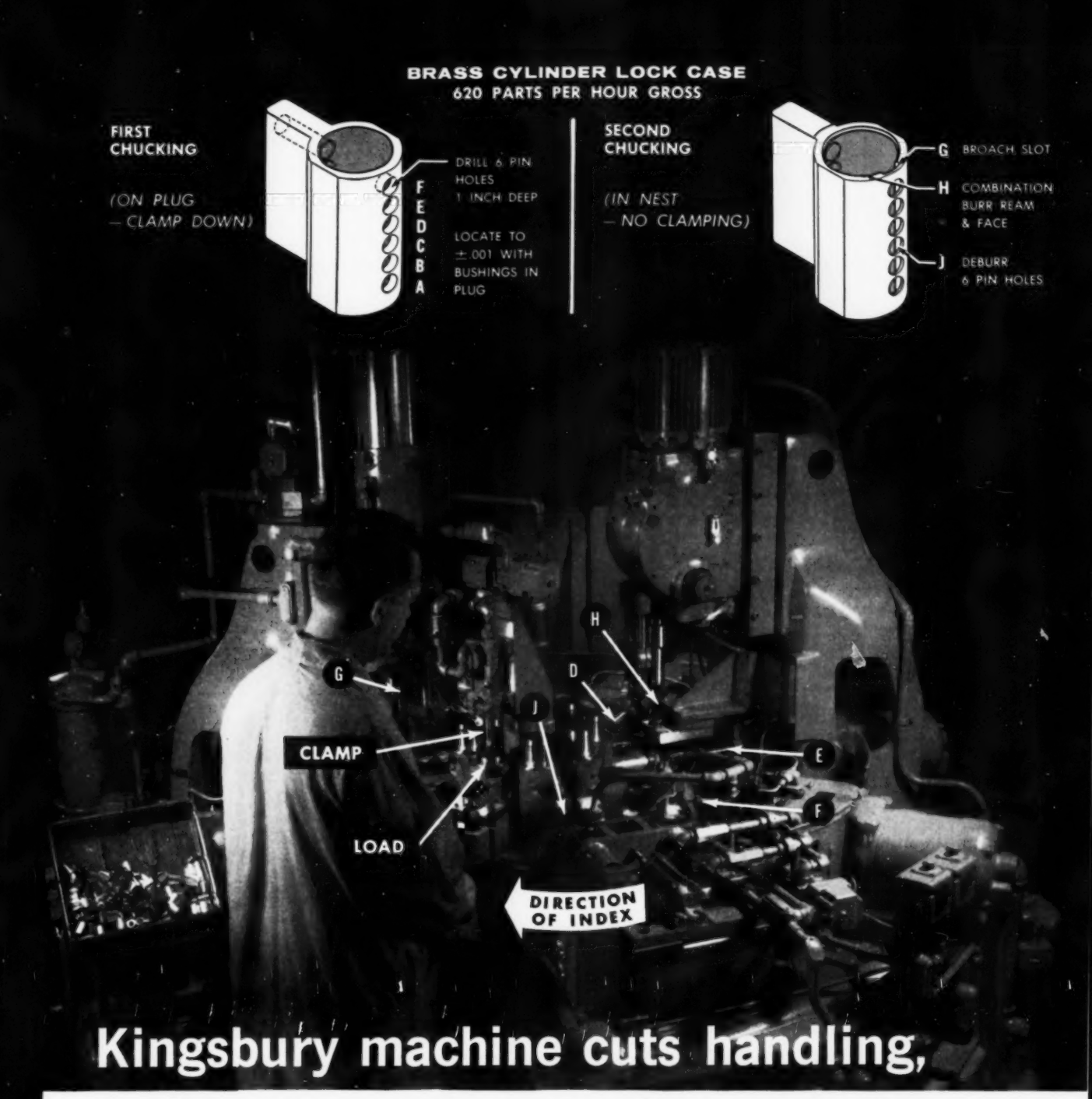
RM 947

WRITE TO DIAMOND WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls



Kingsbury machine cuts handling, makes big savings on Dexter locks

"Too much handling of lock parts causes nicking and burring. Then the assembled locks bind and we have to rework them," says Dexter Industries, Inc., of Grand Rapids, Michigan.

"Our new Kingsbury has cut our handling way down, eliminating nicks and increasing production by combining several operations in two chuckings of the work. We're delighted with it."

Each part passes twice around the machine. In the first chucking horizontal units at six stations drill the six pin holes, locating within .001. In the second chucking vertical units operate a broach and a combination tool. The last operation deburrs the pin holes; an air cylinder pushes removable pins on a block into the six pin holes.

Typical of what we can do for you. This setup resulted from the joint efforts of our sales engineers and representatives with Dexter's engineers and production men.

If you have drilling type operations in high production, may we make a proposal? Your Kingsbury will have good basic design and accurate rugged construction. It will be ready to produce when you receive it and will keep on producing. Kingsbury Machine Tool Corp., Keene, N. H.

KINGSBURY MULTI-UNIT AUTOMATICS

for complete flexibility in rapid automatic fastening

the NEW r.a.f. screw driver by Ingersoll-Rand

You get complete flexibility by moving, adding or removing powerheads—by varying screw types or sizes—or by adjusting power ranges to meet different torque requirements.

Now you can automate your fastening operations without buying expensive, custom-built fastening equipment. With the versatile, new R.A.F. Screw Driver, you can run one job in the morning, and a completely different job after lunch. Changing the screw pattern is as simple as loosening and then tightening two powerhead bolts.

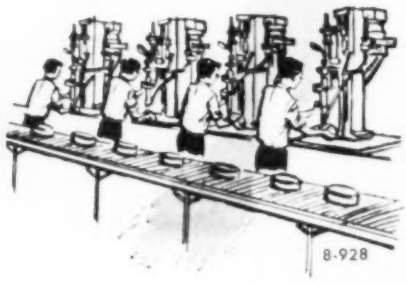
dividends on payroll dollars

Using the new R.A.F. Screw Driver, one man can outperform a half dozen operators using conventional hand held screw drivers. As an example of savings possible with Rapid Automatic Fastening, multiply the yearly wage you pay one operator by the number of operators the R.A.F. Screw Driver replaces. This figure, minus the cost of the R.A.F. Screw Driver, represents your Dividend on Payroll Dollars for the first year alone.

For the full story on Dividend Dollars with Rapid Automatic Fastening, call your local Ingersoll-Rand office today, or write for Bulletin 5266.

✶ in small shops

✶ on assembly lines



Ingersoll-Rand

11 Broadway New York 4, N.Y.

Tools plus AIRengineering increase output per man

Want a Press to Triple Your Forging Output?

We'll build the press for all your forging requirements . . .

Tell us your forging problems and give us your production specifications—we'll do the rest.

Erie Foundry, one of the first companies to automate forging, can provide specially designed *high volume* presses in capacities of 1000 to 8000 tons. Instead of the three machines and nine men formerly required, now you need only one Erie automated forging press and only one operator observer—to triple your present production rate! Trimming, too, can be accomplished in a single production cycle. With billet supply and finished part removal conveyorized, it is possible to achieve a production volume of, say, 1200 track-link forgings per hour.

Erie Foundry has a complete line of machines designed for high volume production of such parts as connecting rods, gear blanks, automotive and tractor valves, pinions, track links and wheel hubs.

We would like to discuss application of automated presses to your production requirements. For the complete story, phone or write Mr. R. E. Sanford, Erie Foundry Company, Erie 4, Pa.

ERIE

ERIE FOUNDRY CO.

The world's great name in forging since 1895 EF 59-01

CIRCLE 386 READER SERVICE CARD

NEW

ERICKSON

MASTER SPACER

with No. 0 Timken Bearings

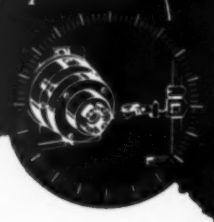
gives increased production and optimum accuracy in

straddle milling

milling

jig drilling
with either micrometer or "Jo" block setting

inspection



Write for free catalog "Erickson Master Spacer" today. And at the same time request your copy of Catalog K; you'll find cost-slashing applications for all Erickson holding tools.

The new Erickson Master Spacer quickly and accurately positions work for a wide variety of jobs. This *one* tool can eliminate expensive jigs and fixtures . . . makes it a simple procedure to set up drilling, milling, boring and special machining operations.

The new Erickson Master Spacer, ideal for tool room and production machining, assures outstanding performance under heavy helical cuts and slow feeds. *Indexing accuracy guaranteed within .001-inch cumulative error on a 6-inch diameter circle.* Jig drilling is possible with either micrometer or "Jo" block setting. Timken bearing construction permits work to be trued in position with brake off because spindle alignment remains unchanged.

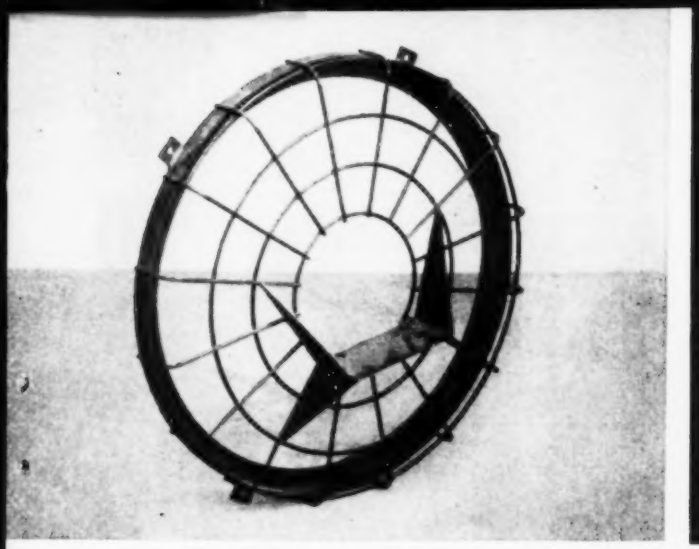
The new Erickson Master Spacer can help you come to grips with your Number One Problem—high production costs. The first step is to get the Erickson story.

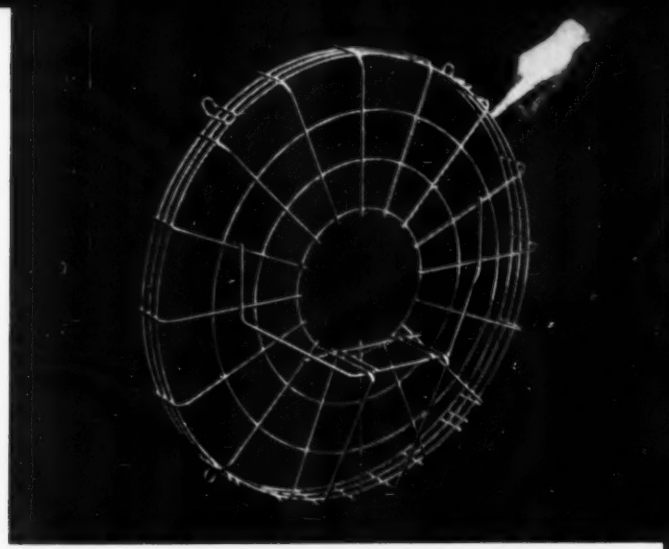
AA 3081

ERICKSON TOOL COMPANY

34459-11 Solon Road • Solon, Ohio

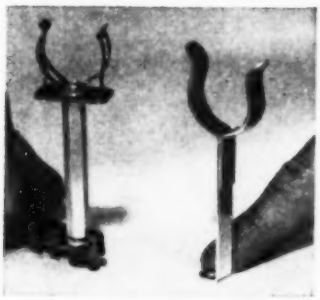
COLLET CHUCKS • FLOATING HOLDERS • TAP CHUCKS • TAP HOLDERS • AIR-OPERATED CHUCKS
EXPANDING MANDRELS • EXPANDING-COLLETS • SPECIAL HOLDING FIXTURES





MOTOR MOUNT AND GUARD for a transformer cooling fan. The all-wire piece, right, reduced cost to one third of former price, and weight from 24 lb to 13½ lb. The ¼-in. and ⅜-in. welded steel wire design, replacing the strip, wire frame, and cast rim assembly, also allowed closer tolerances.

How redesigning with steel wire



BRACKET to hold two-way radio plugs on chassis. Cost reduction was 75 pct and weight savings 50 pct when the complicated six-part assembly was eliminated. Manufacturing time of this simple, two-part, ⅜-in. x ⅛-in., flat steel wire design, right, was considerably reduced.

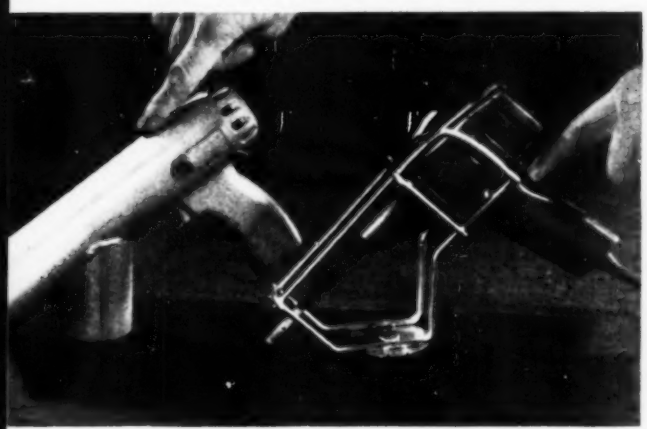
. . . cuts costs

. . . adds strength

. . . saves time

. . . reduces weight

HOLSTER for electric tool. The open wire frame reduced weight by 10 pct and cost by 66 pct. Replacing the welded tubing part, left, this steel wire assembly lends versatility in that it fits several types of tools.



These four examples show clearly why engineers and designers so frequently turn to steel wire for lower costs, simpler designs, and faster production.

Bethlehem makes wire for literally thousands of uses: upholstery spring wire, wire for cold-heading, wire for welded products, wire for handles, communications wire, etc. We regularly produce many grades of steel wire, with various coatings, processed in many ways to meet specific application requirements. Whether you need an ordinary or a special-purpose grade—our modern wire mills can produce it.

Our wire experts are at your service. A letter or call to your nearest Bethlehem sales office is all that's necessary.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

These case histories were furnished through the courtesy of E. H. Titchener and Co., Binghamton, N. Y., a regular user of Bethlehem wire.

BETHLEHEM STEEL

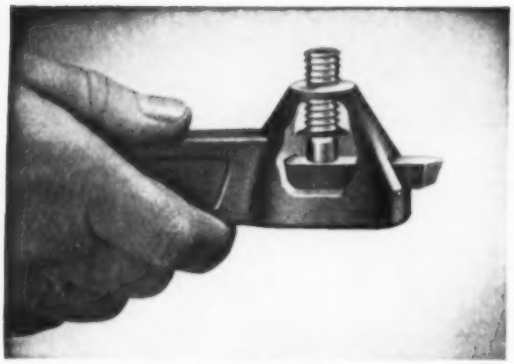
BETHLEHEM STEEL

CIRCLE 388 READER SERVICE CARD

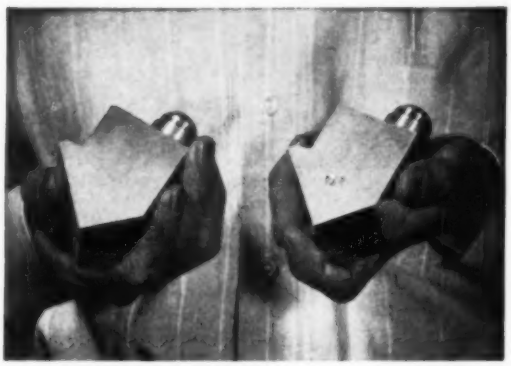
Practical Tooling Tips

NUMBER 1 OF A SERIES

Everyday more and more shops are using standard Vlier Tooling Accessories in place of custom-made devices for both tooling and original equipment applications. The precision construction, product uniformity and quick availability of these simple time-savers have made them tool room favorites. Why don't you start saving from their use?

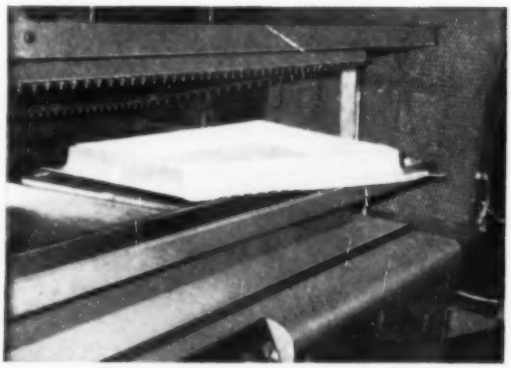


TO GET GREATER TOOL BIT RIGIDITY replace the tool holder screw with a Vlier Swivel-Pad© Clamp. The large, flat pad face provides many times more clamping area. Bits can be held tighter, reducing chatter and vibration. Small, narrow cut-off blades, multi-point tools, even stub ends can be rigidly held. Unique ball joint construction gives smooth angle adjustment in all directions.



EASY WAY TO STOP MARRING surface of part held in fixture. The part on the left was securely held in the fixture with a Vlier Swivel-Pad© Clamp. The scrapped part on the right was held with an ordinary set screw. With the Vlier Swivel-Pad© Clamp the pad stops at first contact with the part; screw torque is absorbed by a ball, preventing damage to the part. This exclusive ball joint construction also provides adjustment to off-angle surfaces.

SPRING PLUNGERS LET WRENCH DO MULTIPLE DUTY—The compression tool shown above is used to attach connectors to electrical wires. Formerly, each size wire connector required a different size tool. But now, through the use of Vlier Spring Plungers, one tool attaches all sizes of connectors—through the use of changeable jaws. The appropriate jaw for any size connector is easily inserted, accurately positioned, and held in place with a Vlier Spring Plunger.



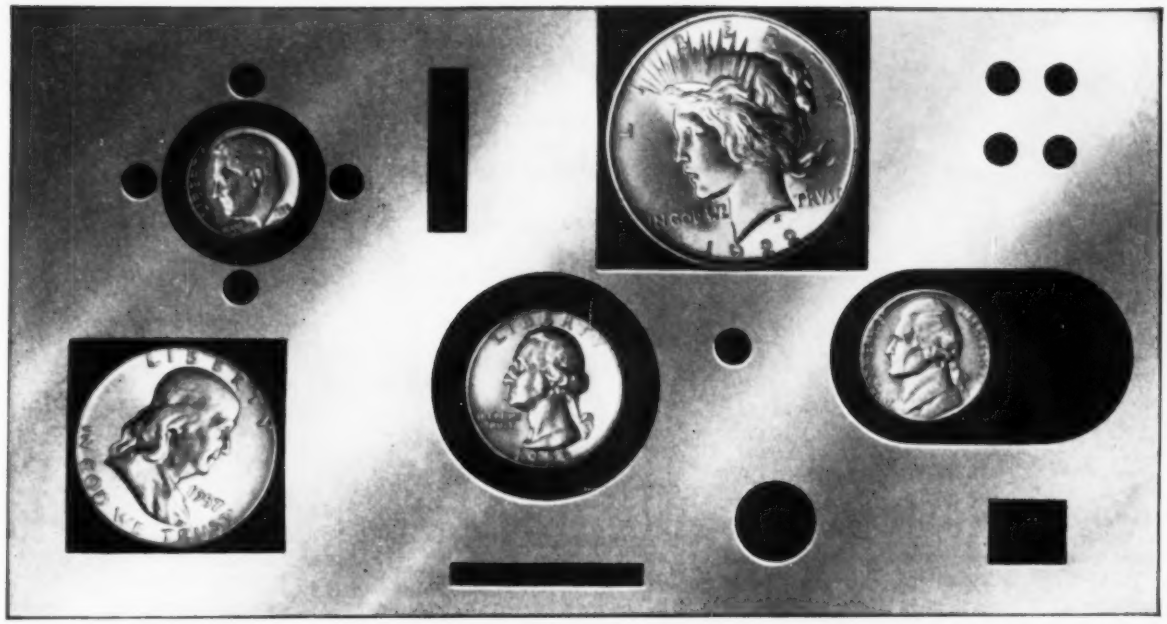
THE RIGHT AMOUNT OF END PRESSURE AND NO MORE is what this spring plunger application calls for. More than 150 Vlier Spring Plungers are used to hold a plastic sheet in position during the forming operation of a plastic refrigerator door liner. Spring Plungers provide just the right amount of pressure to produce a perfect liner.

New catalog now ready! Send for your copy today.

Insist on Vlier Tooling Specialties... there's still no substitute for quality.

VLIER ENGINEERING CORPORATION

A Subsidiary of Barry Controls, Inc.
8900 Santa Monica Blvd., Los Angeles 46, California



How Much Are You Paying for Holes?

Producing openings in low quantity work can be costly and time consuming, or it can be a simple, high speed operation —the difference is a Wiedemann Turret Punch Press.

Only a Wiedemann gives you:

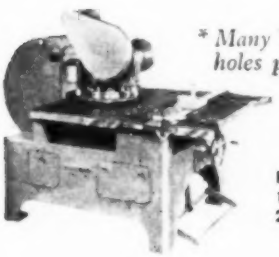
1. the speed of a punch press.
2. the immediate availability of a variety of punches and dies in a turret—no setup.
3. a quick setting, mechanical work positioning gauge—no layout.

Parts are produced as needed, and even extensive engineering changes can be made on-the-spot. Holes are produced for as little as a penny each* with standard tooling, and only one punch and die of a size is required. With direct savings of 60% to 90%, the press pays for itself in one to two years.

Take a closer look at the savings you can expect with the Wiedemann Method. Send drawings of your work for time study and write for Bulletin 301.

TYPICAL WORK PRODUCED ON WIEDEMANN TURRET PUNCH PRESSES

- Aircraft and missile components.
- Road building equipment and trucks: mixers, spreaders, shovels, cranes, etc.
- Electrical panels, switchgear, housings, cubicles and components.
- Electronic chassis: control, television, radar, computers, etc.
- Industrial refrigeration, laundry, baking, kitchen, food dispensers and similar equipment.
- Instrument mountings and panels.
- Air conditioning: housings, baffles, etc.
- Pre-production prototypes.
- Machinery: fabricated bases, side structures, conveyors, etc.

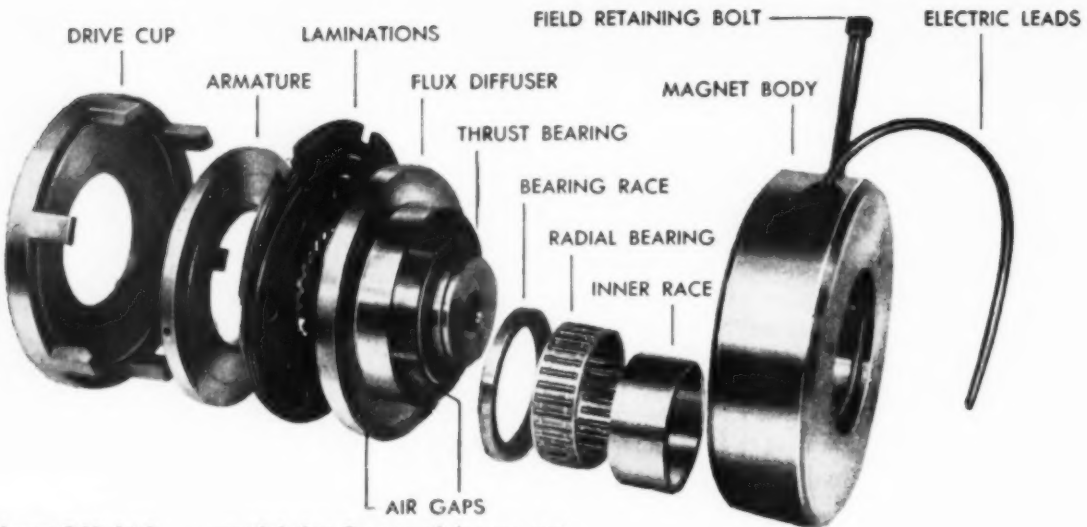


RA-41P Wiedemann
15-ton capacity
28" throat depth

** Many Wiedemann users are selling holes profitably at a penny apiece.*

WIEDEMANN MACHINE COMPANY
TURRET PUNCH PRESSES

DEPT. AM-11 • GULPH ROAD • KING OF PRUSSIA, PA.



Stationary field clutch . . . expanded view. See strength in every part. Roller-type thrust bearing packs enormous load-carrying capacity into small space. It is a type proved in automotive transmissions for years.

DURABILITY

The *durability* of I-T-E Electro-Clutches is one of the big reasons for making them your choice. Bearing life is equal to machine life. Each design of clutch is operated 100,000 times before torque rating is determined. After that, it is required to run several hundred thousand additional operations without loss of torque or need for maintenance of any kind. Nothing matches them.

FAST, FIRM CLUTCHING

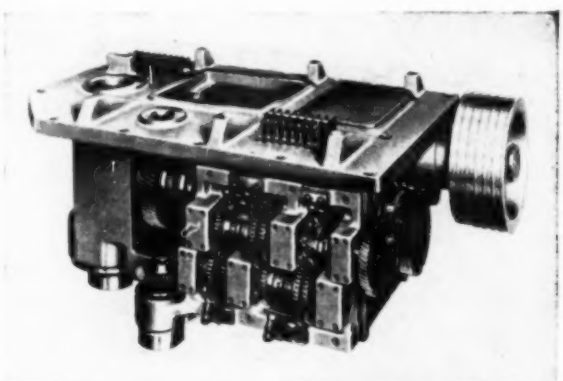
Clutching action takes place between interleaved laminations of *hardened steel* . . . not friction material or sintered nonferrous metals. The clutch lasts as long as the machine. No other clutch on the market offers such durability. In addition, because it has a fixed air gap, there are never any adjustments or loss of performance with age.

NEW MODEL NEVER NEEDS UPKEEP

Recently I-T-E introduced the *stationary field* Electro-Clutch that does away with the slipring and brush. So there is never anything to service. And never anything to replace. This means that designers can bury the clutch deep inside a drive box or transmission . . . for access is never needed. For easy assembly, they slide right on the shafts as one unit.

WIDE RANGE OF TYPES AND SIZES

I-T-E Electro-Clutches are available to fit your own shafts and in torque ratings from 3.2 to 13,000 lb-ft. Stock voltage ratings are 24 and 90 v d-c. Other control voltages provided on request. Write for complete details. I-T-E Circuit Breaker Company, 1900 Hamilton St., Philadelphia 30, Pa.



They go inside with the gears and the oil. This is the main transmission of a Fosdick Precision Jig Borer. You can scarcely see the 13 standard I-T-E Electro-Clutches. But they are there . . . mounted right on the same shafts with the gears. Because they operate in an oily atmosphere, they save transmission space and simplify design.

I-T-E CIRCUIT BREAKER COMPANY

Forming sides *of a Flo-Matic box at Powell Pressed Steel Co., Powell uses Youngstown Hot-Rolled and Cold-Rolled Sheets, reports operational uniformity, low fabrication cost.*

Accent on Excellence

Youngstown hot-rolled and cold-rolled sheets

ORIGINATORS OF COLD FORMED, ALL STEEL MATERIALS HANDLING CONTAINERS

Ingenious Flo-Matic Systems simplify flow of work in process, eliminate costly, multiple production handling.

Fabrication of Flo-Matic Systems involves shearing, blanking, piercing, pressing, forming and welding. The Powell Pressed Steel Co., Hubbard, Ohio, uses Youngstown Hot-Rolled and Cold-Rolled Sheets for consistent specified product quality. Thus, Youngstown steels help Powell keep product cost well in line—a matter of no small importance in selling to the materials handling equipment market.

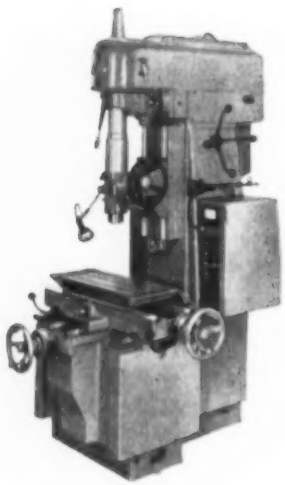
Wherever steel becomes a part of things *you* make, the high standards of Youngstown *quality*, the personal touch in Youngstown *service* will help you create products with an "accent on excellence". The Youngstown Sheet and Tube Company, Youngstown, Ohio. Carbon, Alloy and Yoloy Steel.

Youngstown

CIRCLE 392 READER SERVICE CARD

Accuracy to the split-tenths

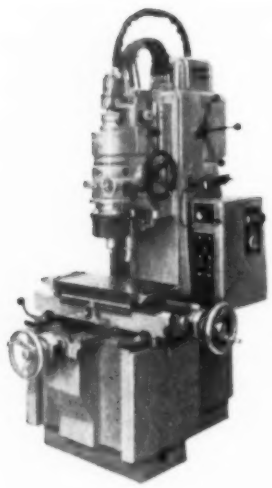
FLASH! All Moore machines shipped after February 15, 1959 are made and calibrated to the New International Inch.



LOCATES AND BORES HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Borer

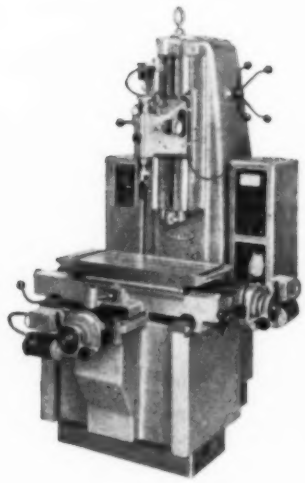
For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equaled. Now, with this new and larger No. 3 model, you will break the "tenth" barrier! Here's why: it offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive...wider speed range 60 to 2250 RPM...larger table working surface, 11" x 24"...micro setting of vernier dial...more accessible cross-clamping. These new features, plus sensitive, centralized controls for spindle speeds and feeds, quick tool-changing, easy lubrication add up to a Jig Borer which belongs in every toolroom where *tomorrow's accuracies must be achieved today!*



LOCATES AND GRINDS HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Grinder

The originators of jig grinding and the Jig Grinder have done it again! Now, with this new, larger No. 3 model, you can grind—*with split-tenth accuracy*—holes plus regular and irregular contours to size and location after hardening. This is made possible by the closer locational tolerances built into the machine...by the all-hardened-ground-and-lapped ways...by the faster strokes provided for chop-grinding...by the infinite spindle speeds, 40 to 250 RPM...by the larger table working surface, 11" x 24". The same quickly set precision lead screws as in the Moore Jig Borer simplify the finish-grinding process.



MEASURES TO ONE-THIRD OF A "TENTH"

Moore Universal Measuring Machine

This machine, built on the same basic principles as the No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder, introduces a new concept in ultra-precise measurement and inspection. It offers *for the first time*: A machine combining the capacity for larger work-pieces; choice of electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. Design and construction insure the highest possible accuracy. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive—it's optional (for Measuring Machine only).

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

why make parts the slow, costly way?

COLD-HEAD THEM!

Steel

Tappet plunger, splined square-head shaft, collar for adjustment wedge, universal joint bearing cup, pipe plug, spark plug body.

Copper

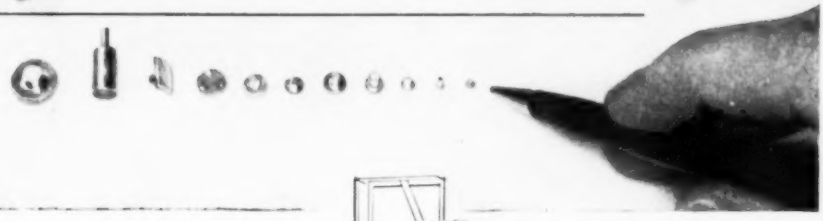
Ornamental stud, distributor cap center insert, commutator bar, wire clamp, solenoid contact, starter field terminal.

Aluminum

Hollow rivet, blind rivet, flanged collar, link, distributor cap outside insert.

Precious Metals

Electrical contact, transistor case, miscellaneous rivets and electrical contacts.



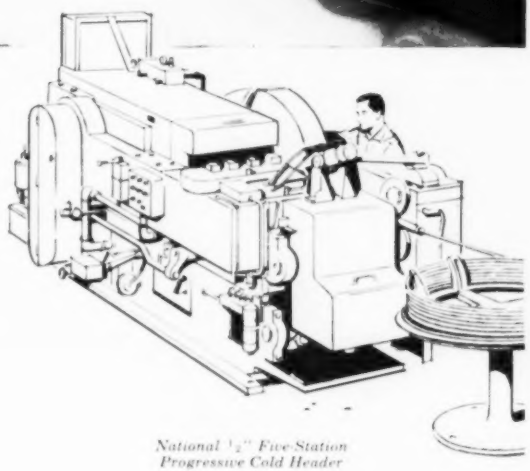
Of various metals, the parts identified above were developed for fast, accurate production on National Cold Headers.

Most of these important jobs are made without waste, ready for end use. All are cold-forged from coiled wire – start-to-finish in one compact Header – without any intermediate steps.

New technical break-throughs are making jobs like the above every day commercial realities. More workable wire, better lubricants, improved die materials and vast engineering experience are combining to adapt formerly difficult work to modern, profitable methods.

Whether you now have Headers or not, send us prints or samples of your jobs, or bring them to Tiffin where more of our people can help with *your* problem.

Perhaps up-to-date Cold Heading, a truly fast-growing process in metalworking, can pay off for you.



National 1½" Five-Station Progressive Cold Header

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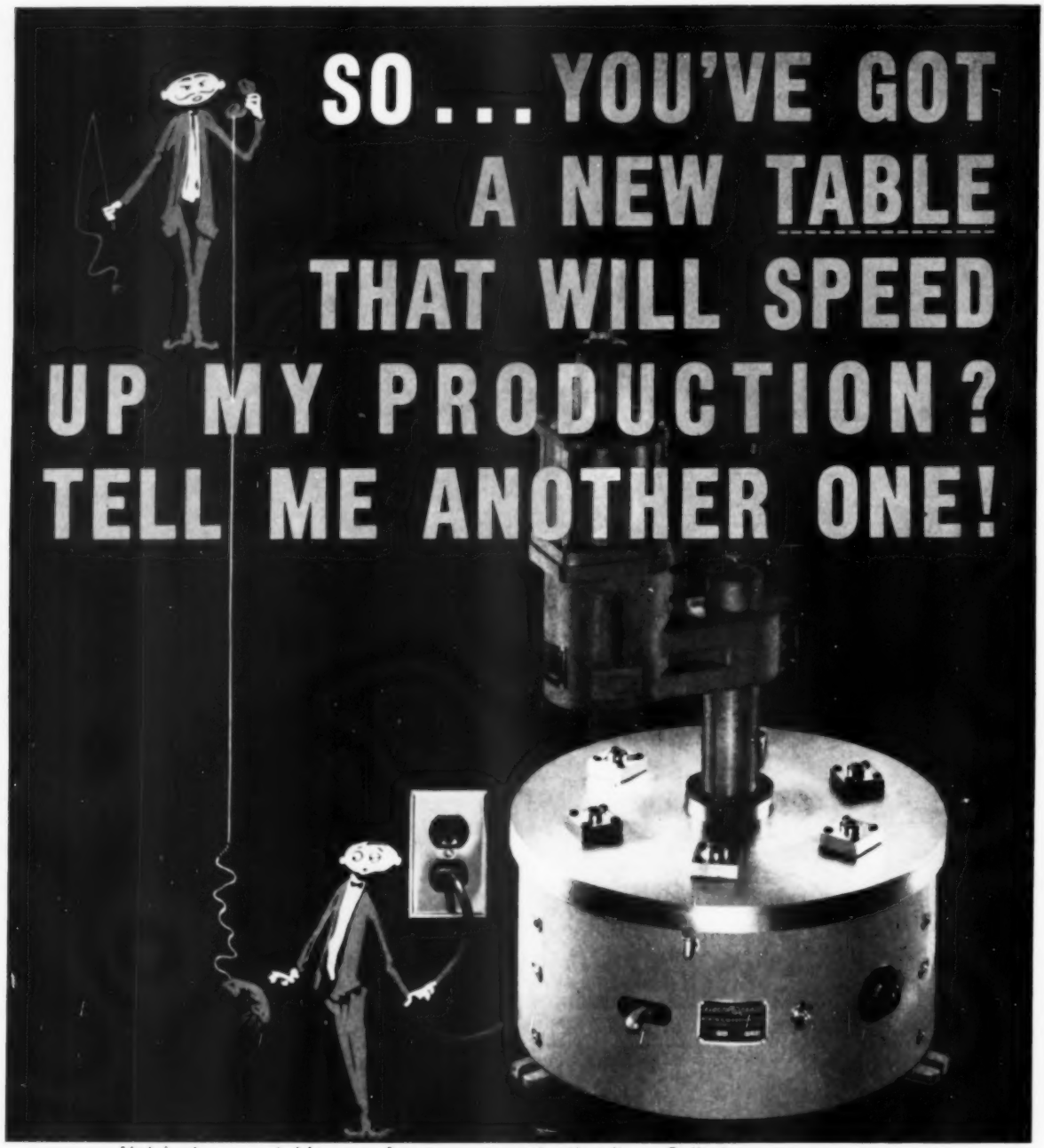

Not just a new table, no. A one-man production line. Called ***ELECTROTABLE***. All electric. Smooth, jolt-free Geneva action that can't be duplicated with air-operated tables. Built-in electronic timer. Easy on bench space. Positions work automatically, accurately, safely... and triggers other tools (preferably our own Electropunches) for various operations like staking, riveting or marking—to name just three. Six, eight, or twelve-station models. Adjustable speeds from 14-48 indices a minute. Indexing accuracy, .001". To change jobs, just lift turntable off, put new one on. Add automatic feeds... you've got automation! Like for example, hypodermic needle manufacturer — upped his hourly production from 1,500 to 4,000 using full automatic feed. Like component maker, who combined feeding, assembly, staking and went from 600 up to 2,000 units an hour. Worth investigating? Hope you'll think so.

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ELECTROTABLE SPECIFICATIONS

Model LT — Counterclockwise Rotation

Model RT — Clockwise Rotation

Stations — 6, 8 and 12

Speed — continuously adjustable between 14 and 48 indices per minute.

(A timer that will provide 6 to 25 indices per minute is also available.)

Time for motion during one index .693 seconds

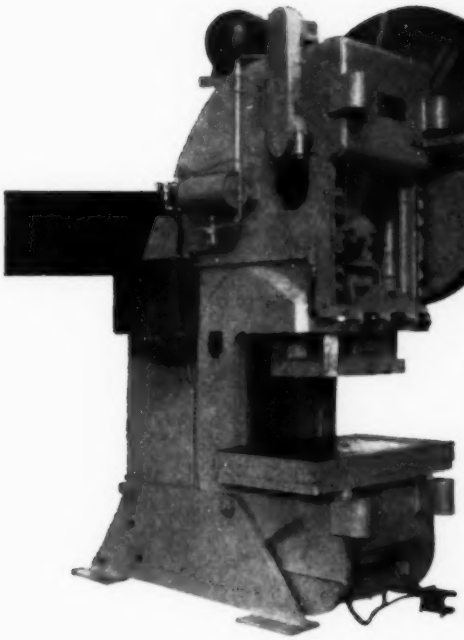
Indexing accuracy, ±.001

Diameter of table — 15¼"

Height of table above bench, 7¼"

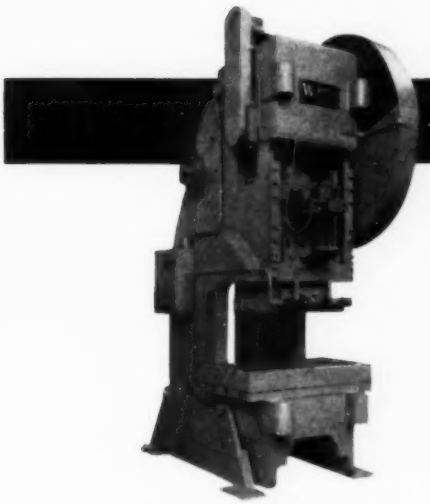
Weight of unit less Electropunch head — 82½ lbs.

Electrical requirement: 115V or 230V AC, 50-60 cycle, 1 phase



200-ton standard

Warco®



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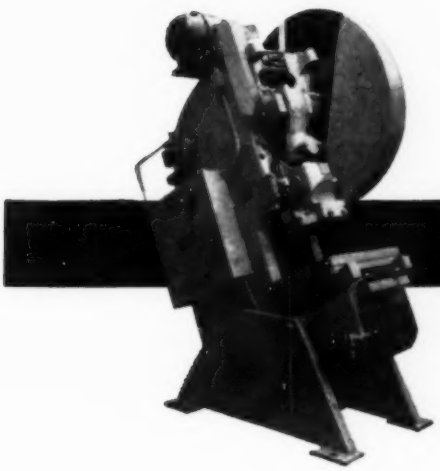

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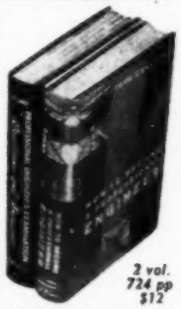

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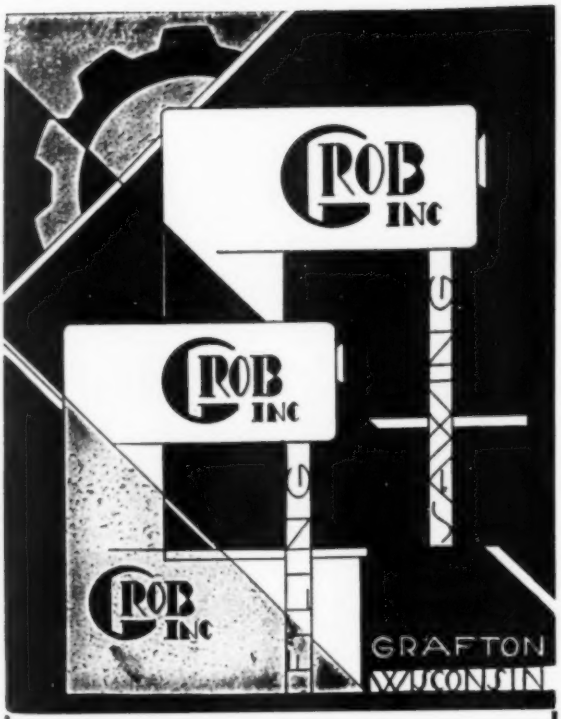

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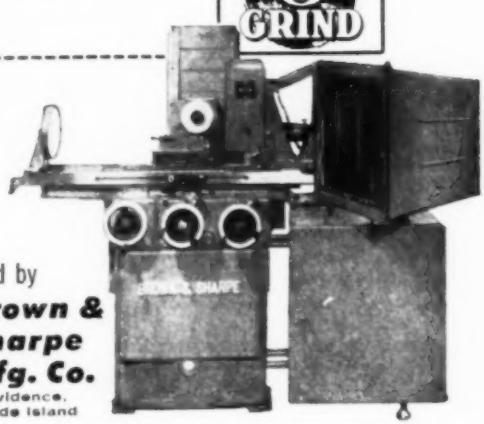

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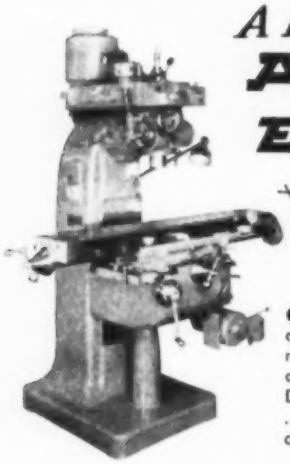

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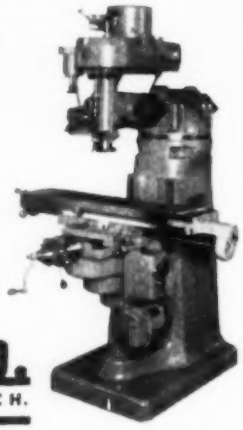

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Fig. 1—Tough outer scale and chilled edges on these hot-rolled steel bolster plates and eccentric straps made them costly to mill.

Fig. 2—Surface grinding not only reduced costs but improved finish and accuracy. Stock removal is between .040" and .060".

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Fig. 3—Important machine features for high stock removal are: 60-hp spindle motor; rigid, heavy construction; outside coolant tank; and continuous downfeed.

Fig. 4—Setup costs were reduced because no clamping is required as with cutter-type machining.

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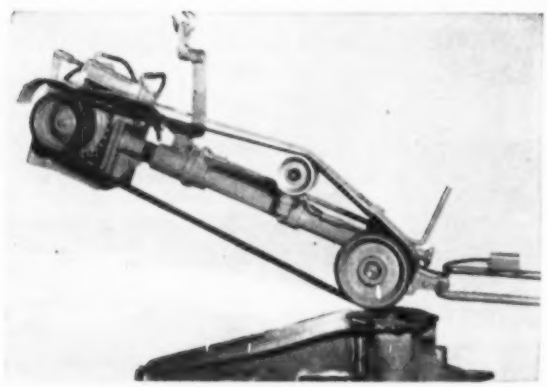

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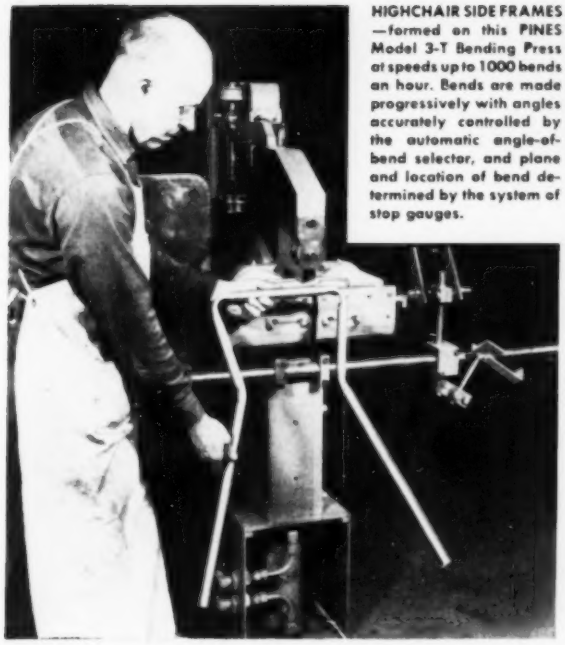

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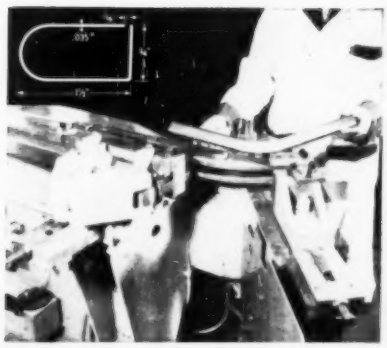

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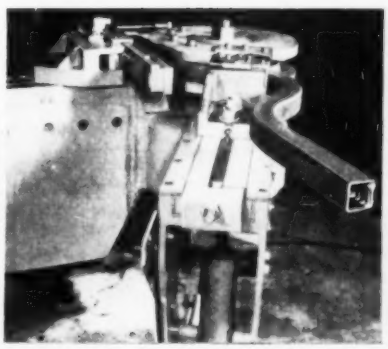
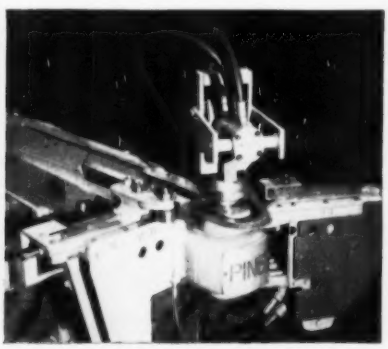


SQUARE-TUBE VEHICLE FRAMES—Bending of SAE 4140 steel tubing, 3" square x .239" wall on 10½" radius is done on this Model 4 Bender. Tooling illustrates use of compound die for clamping on bent section.



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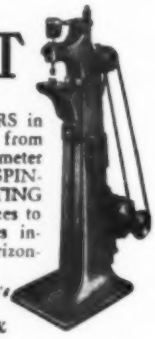

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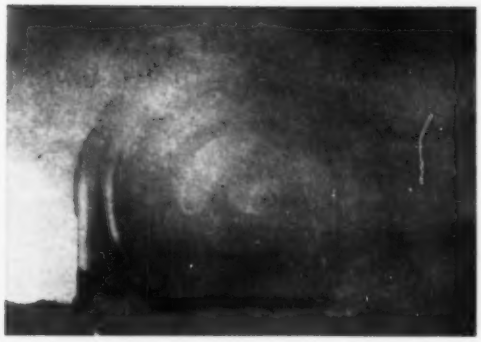

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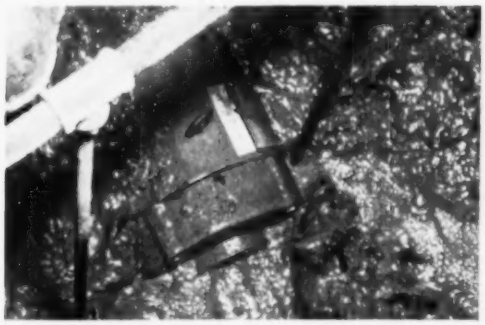

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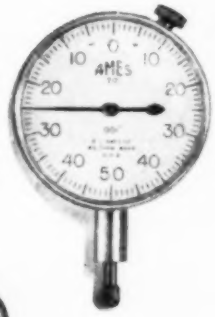

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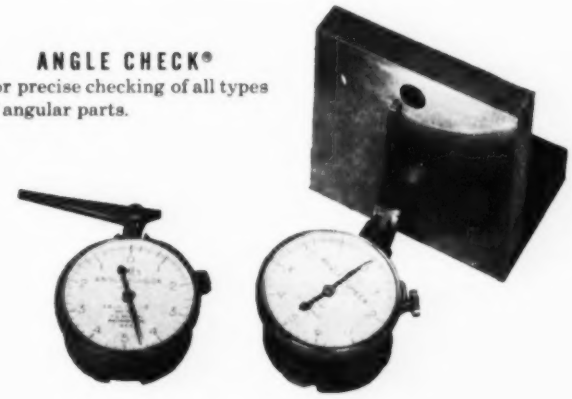

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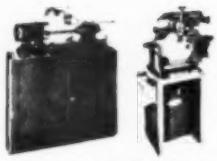

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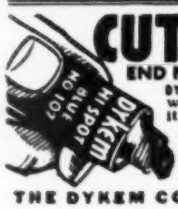

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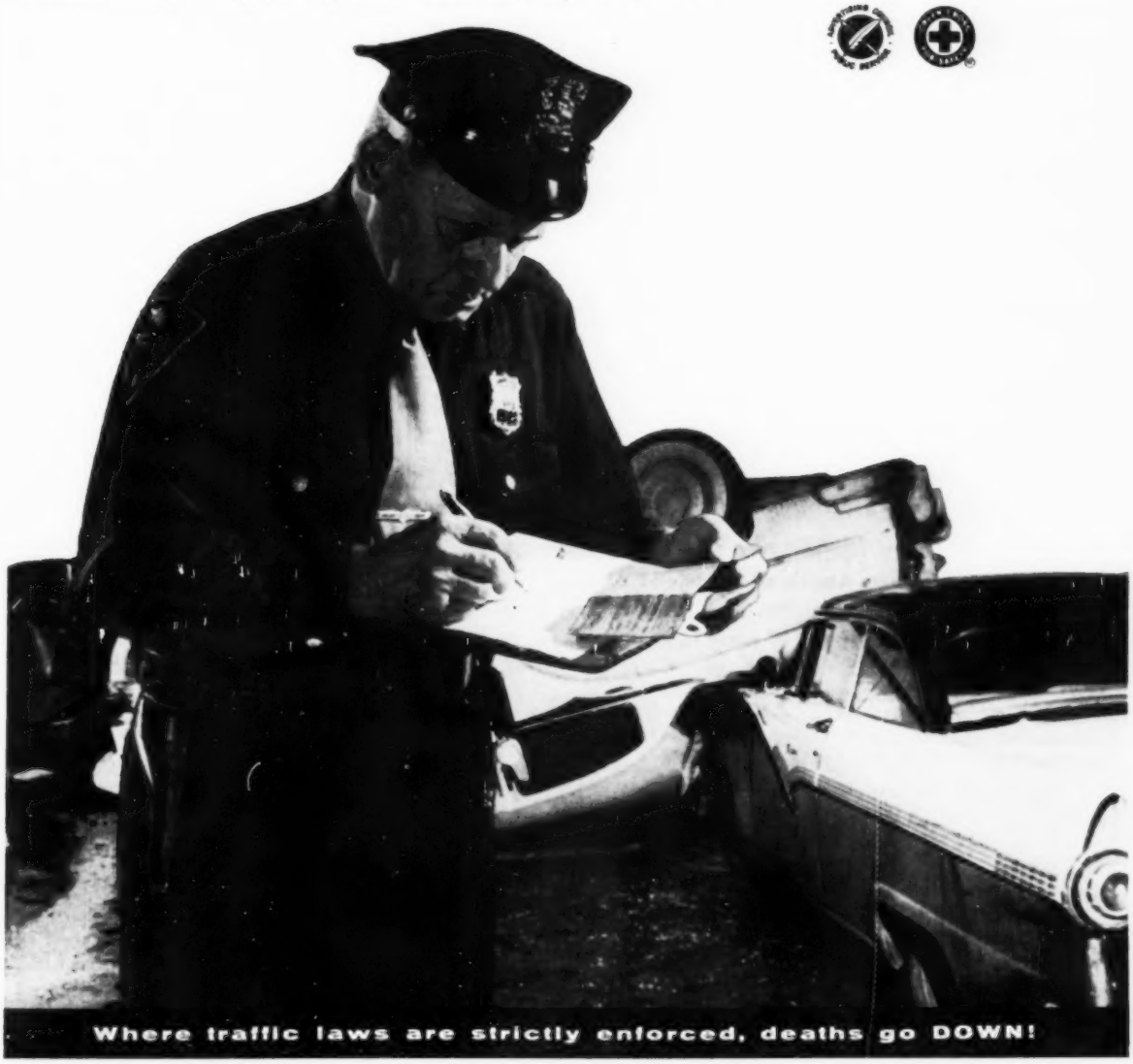

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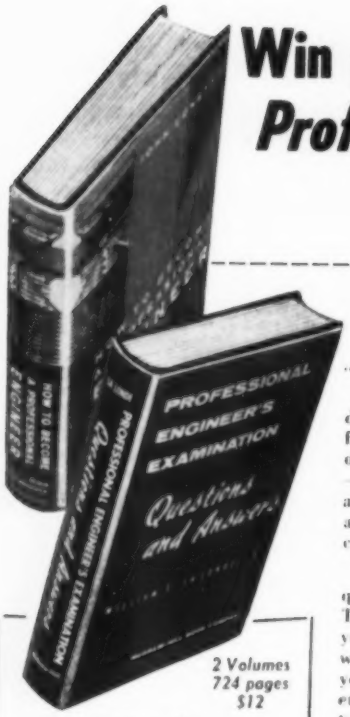

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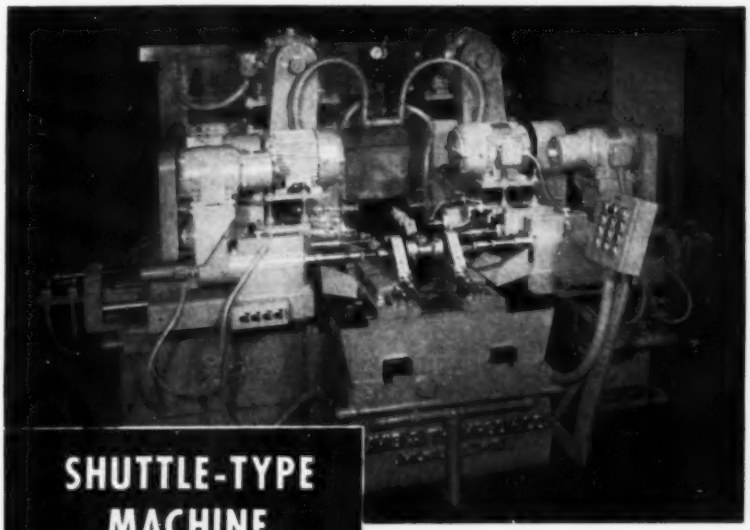

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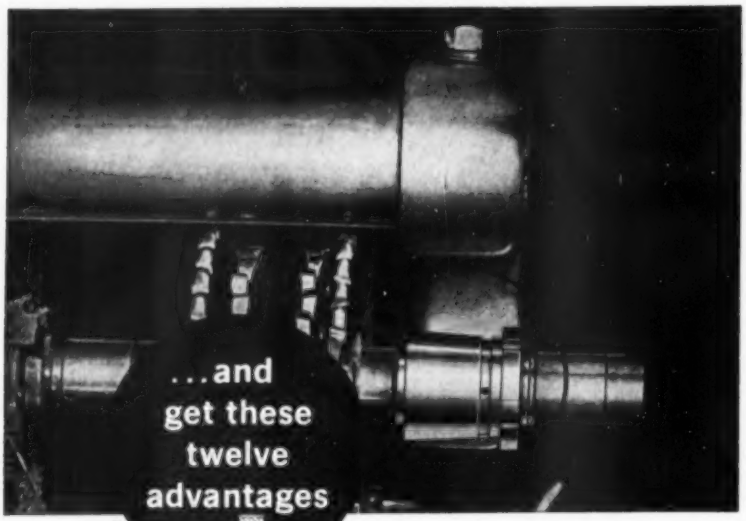

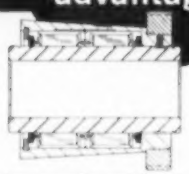

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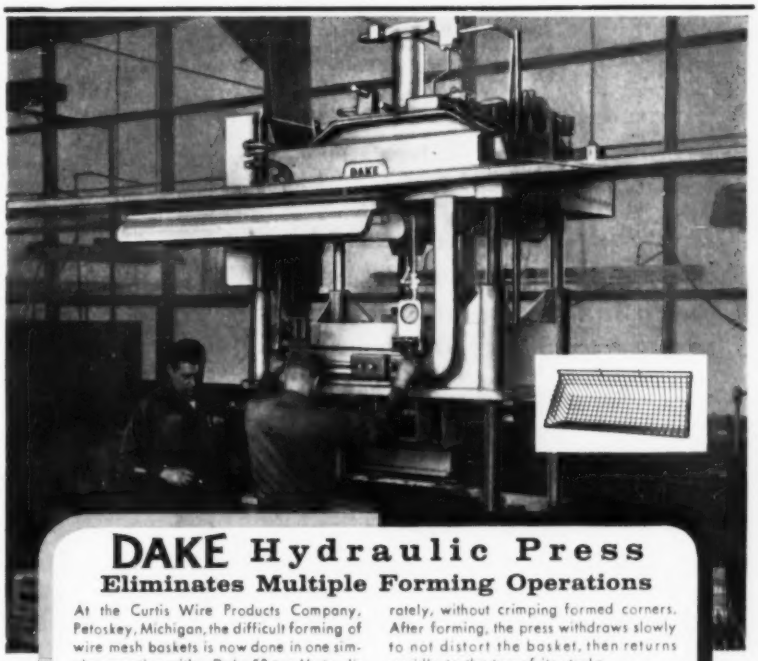

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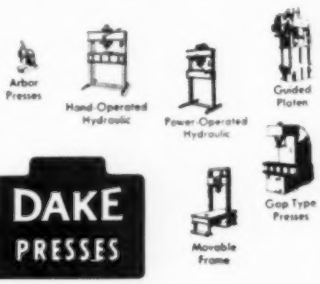

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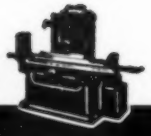

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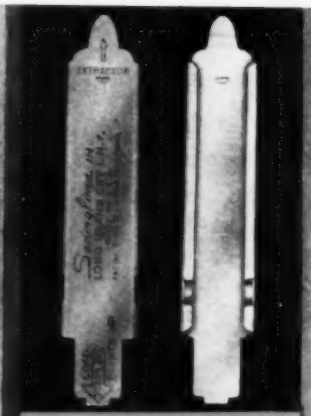

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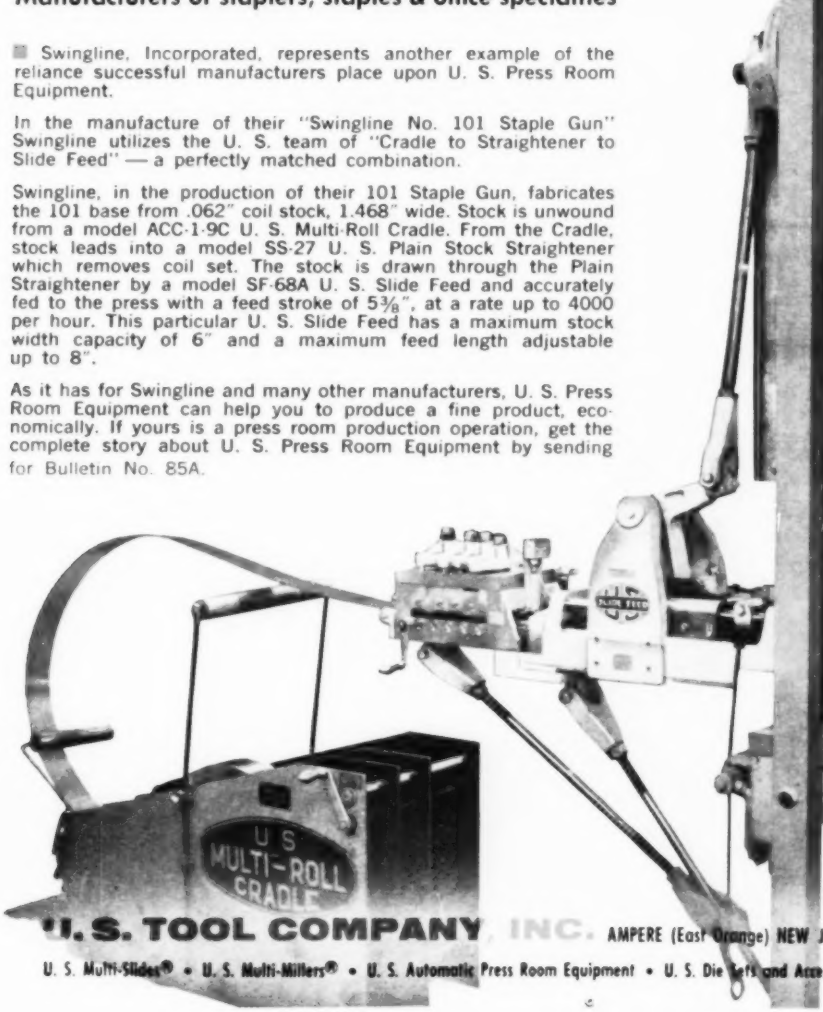

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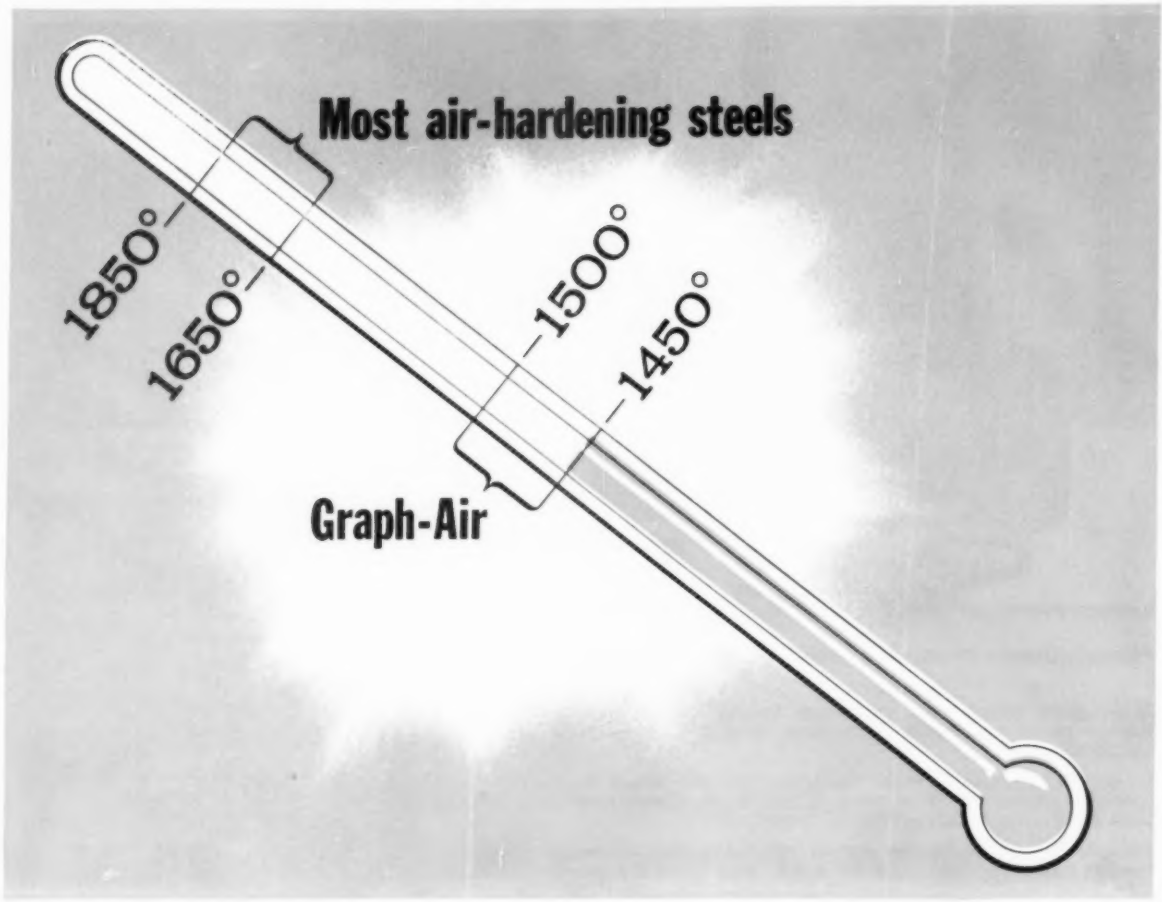

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